110-ELECTRONIC ENGINEERING EDITION

HIMOIS U. LIDIAI

ADIO & PELEVISION NEWS

OCTOBER 1953

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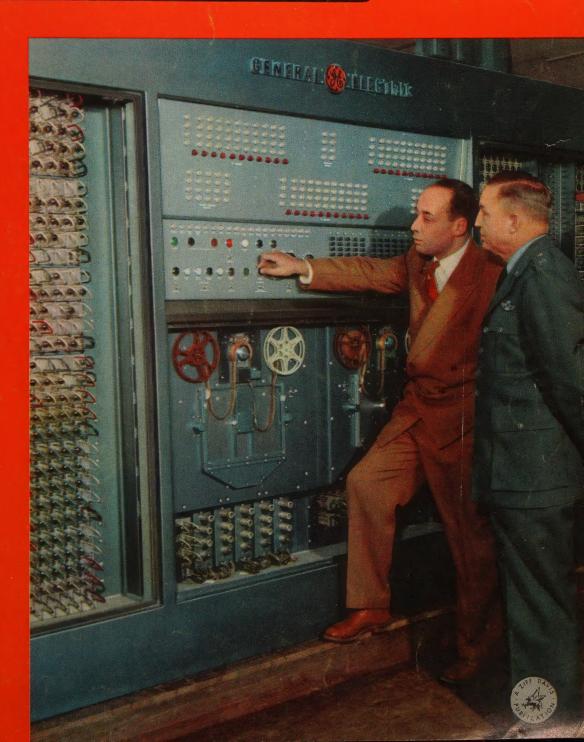
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YOUR 1954
RECEIVERS

E DARAC

Page 83)



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your shingle:

IT PAYS TO KEEP GOOD COMPANY... and it's good business to advertise the good company you keep.

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sion: Pick-up Operator, Voice Transmitter Operator, Television Technician, Remote Control Operator, Service and Maintenance Technician.



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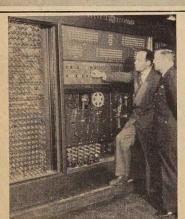
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COVER PHOTO: Brig. Gen. Leighton I. Davis, director of armament for the U.S. Air Force Air Research & Development Command, inspects the General Electric digital computer, OARAC, with C. R. Wayne, a G-E computer engineer. (Ektachrome by J. Franc)

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CONTENTS

OCTOBER, 195

Television Sweep Generators	Milton S. Kiver
The Novice Station Receiver (Part 2)	
Larry Trombly, WØDCB & Robert A. Hathaway, WØGTK	
The Klipsch Rebel IV—A Back-Loading Folded C	Frederick I Kantor
TV Tube Substitutions.	Walter H. Buchsbaum
Color TV	
Loudness Control	
New TV Intermittent Checker.	
Electronic Shipyard for Winter Cash	
Skiatron's "Subscriber-Vision"	Rudolf F. Graf
The "Transdipper"	C. A. West, W21YG
Know Your 1954 General Electric TV Receivers	Jack Najork
The "Fold-a-flex"	Oliver Read
A Transistor Timer	Louis E. Garner, Jr.
Certified Record Revue	
Improved Kappler Amplifier	
The "LPRS" Preamp Control Unit	
A Student Regenerative Receiver	
Bring Your TV Set Up-to-Date	
Brightness Control in TV Receivers	
The Oarac	
The Con-VI	
Mac's Radio Service Shop	
High-Fidelity with Crystal Headphones	
The Radio Craftsmen Model C-800 Tuner	
Radio-TV Service Industry News	F 0 5
Make Your Electronic Flash More Versatile	
New TV Stations on the Air	
New TV Grants Since Freeze Lift	
An Adjustable Regulated Voltage Supply	
Simple Speedlamp Tester	
Use Your Defective TV Transformers	Honry A Sotako
An Electronic Metronome	
Lincoln Tunnel Traffic Control.	Leon A. Worlding
New Approach to TV Service.	Carroll W Hoshour
Service Hints on G-E TV Sets.	
	,

DEPARTMENTS

For The Record The Editor	8
Spot Radio News	16
Within the Industry	28
Short-Wave K. R. Boord	82

Technical Books Manufacturers' Literature What's New in Radio.... New TV Products.....



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SUBSCRIPTION SERVICE: All communications concerning subscriptions should be addressed to Circulation Dept., 62
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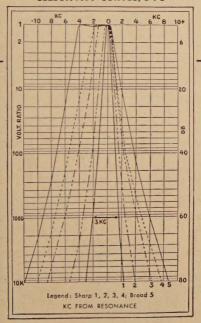
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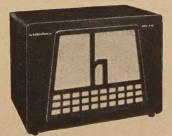
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Thus it will be seen that the interests of subscribers, advertisers, and publishers are interrelated and interdependent, all centered around the heart of any publishing operation-CIRCULATION and RADIO & TELEVI-SION NEWS has the largest A.B.C. (by many thousands) paid circulation of

any magazine in its field.

A key factor in the relations between publishers and advertisers is the manner in which the circulation is reported to advertisers. In order that advertising space may be purchased on the basis of a sound business investment, the circulation of a publication must be substantiated and described in accordance with uniform and accepted standards and terms to permit accurate evaluation (certain radio and TV service publications, please note) and comparison with other media. To accomplish this the Audit Bureau of Circulations was established in 1914. This Bureau, better known as A.B.C., is a voluntary, non-profit, and cooperative association of 3450 advertisers, advertising agencies, and publishers in the United States and Canada. Their first act was to establish a definition for paid circulation, then standards and rules for measuring, auditing, and reporting circulations.

At regular intervals the Bureau's experienced circulation auditors visit all publisher members to audit their circulation records. The information resulting from these audits is issued in A.B.C. reports which are distributed to advertisers and their agencies. These reports answer such questions as "How much circulation?," "Where does it go?," "How was it obtained?" answers that make it possible for publishers to receive full credit for

their circulations and for advertiser to invest their advertising dollars they buy raw materials and equip ment, on the basis of facts and wel known standards. A.B.C., therefore. a major factor in the integrity of re lations between advertisers and pul lishers. Based on this mutual conf. dence, advertisers have appropriate the large amounts for investment advertising which characterize or economy and which are recognized a essential in maintaining the ma communications and mass productions tion that are so much a part of or

general welfare.

This magazine is a member of A.B. Our circulation is known—not guesses at or claimed! Recognizing the direct benefits of the Bureau's work to pub lishers and advertisers, you will as "What does A.B.C. mean to me, one of your readers?" The answers that you are a customer of ours. Ye paid us good money for your subscrition. In order to merit your continue patronage, we know that we muy produce a publication of high editorib quality. Thus our obligation to ye is also an obligation to ourselves, or that must be fulfilled if we are to sta in business. To maintain and built our circulation is a constant incentifor us to provide ever-improvir service to you, our readers—the sara incentive that manufacturers and men chants have in striving always maintain leadership in their fields, provide their customers with superiproducts and superior service.

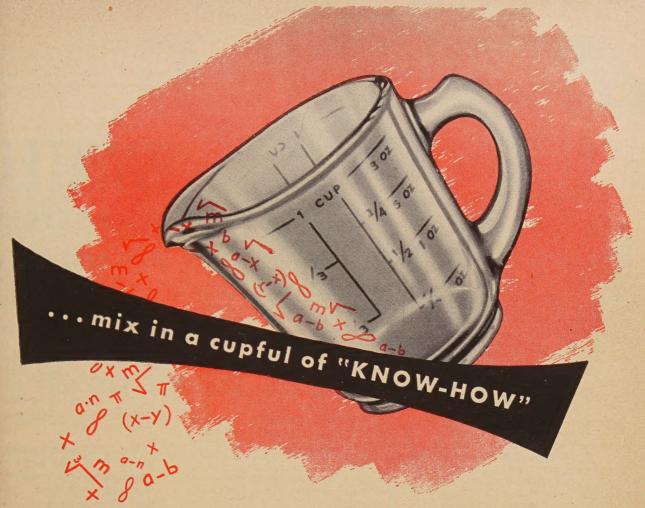
Much more could be written about A.B.C.—how it aids in maintaining free press through its contribution the success of the advertising a publishing industry and as the world outstanding successful example self-regulation in business. This mag zine is proud of its membership in the Audit Bureau of Circulations.

Our 6th annual Audio issue, con ing next month, will include some the very best articles on audio a hi-fi ever published. This Novemb issue promises to break all previous records for circulation and amount

editorial features.

In addition to a wealth of auc material, service technicians and rac amateurs will find a fact-filled section devoted to their interests. No segment of our readership has been overlook in planning the November issue

Incidentally, this special issue w be 50 cents at the newsstands. C regular subscribers receive this " nus" at no extra charge. . . . 0



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* Presenting latest information on the Radio Industry.

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

COMPATIBLE COLOR TELEVISION, a vision, a promise, and a hope for nearly a decade, will at long last become an earthy official reality with the blessings of Washington, and within a matter of but a few months; thanks to an effective petition filed by the NTSC and supporting briefs submitted by members of industry. For the Commission has declared that unless major objections are entered, and at this writing none have been specifically registered, a new color order, replacing the sequential ruling, will be issued.

Even Columbia, whose disc system had been approved in '50, has agreed to go along with the new electronic method. There were a few rumbles of discontent with the compatible standards among some manufacturers. One set and tube maker in Chicago said that he would appeal for a hearing to halt approval, because the suggested system did not cover threedimensional color transmission. Another indicated that since the first runs of color chassis will be costly and beyond the purchasing power of most of the public, the criterion set by the Commission, stipulating that receivers should be moderately priced, has not been met. Neither problem appears to have concerned the Commissioners. The high cost was not looked on as a bar, for in the early days of black and white TV, receivers were far from inexpensive; comparatively speaking they were more costly than the first color sets that will be offered for sale. For not only will there be many more tubes in the red-green-blue chassis, but the picture tube, that is actually three tubes in one, is extremely complex to build.

In Washington and industry, too, it is felt that even if a few dissents are made, satisfactory answers will be found and the green light will shine. According to one timetable, the OK should appear in about thirty to sixty days after comments are received, any hearings are held and approval is officially documented in the Federal Register.

An indication that all was well in the color case appeared a few weeks before NTSC and others transmitted their opinions to Washington. For, in a letter to Dr. Baker, color committee headman, the FCC's chairman had inquired when the NTSC petition would be sent on. The memo from Washington was sparked by the *RCA* petition, which had noted that the . . . "color standards proposed . . are technical signal specifications approved February 2, 1953, by outstanding engineers and scientists of the radio and television industry, including members of the petitioners' staffs, through the National Television System Committee."

The Commission's letter declared that . . . "since the NTSC has been engaged in a program of field testing of the NTSC color television specifications, and in light of the fact that the proposed signal specifications now urged . . are those advanced by your organization, the Commission is desirous of determining when the results of your field testing program will be made available."

The boiling activity in compatible color disturbed some of the Commissioners who had to live through eighteen months of heated color controversy in '49-'50 when the sequential hearings were under way. According to ex-Chairman Paul A. Walker, the earlier sessions were a complete waste of time, because the authorization did not produce color, and black and white television could have had at least a year more behind it, through the earlier approval of the ultra-high channels.

The historic brief filed by the NTSC was an unusually compact document: it contained a report on the signal specs, an opinion on why the NTSC standards meet FCC criteria, and a review of the work that had been assigned to the 10 committees, which comprised the NTSC, and their membership. It also referred to the encyclopaedic appendices that had been filed earlier with the Commission, detailing the reports of each of the committees, the additional comments that were still on their way to Washington, and others that would be filed, as soon as additional data was compiled, for the record.

The proposed standards, said the petition, provide a signal which is capable of operating within a 6-mc. channel and can produce a color picture . . . "which has a high quality of color fidelity, adequate apparent definition, good picture texture (not

WANTED

WHO WILL HELP

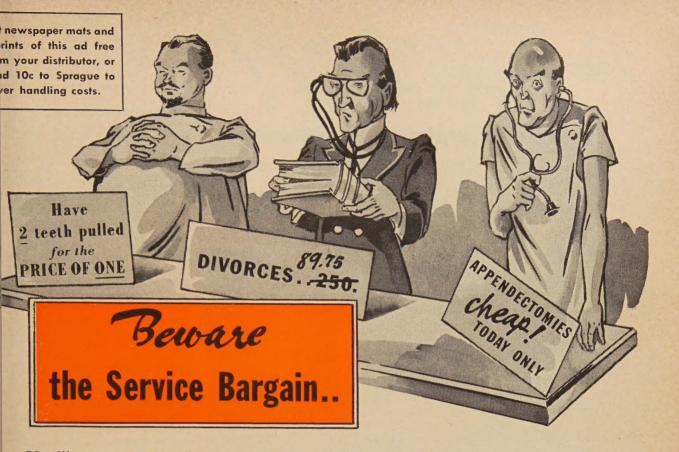
the electronic service technician

Advertisements like the one shown here go a long way toward giving the serviceman the community standing he so rightfully deserves.

But obviously he cannot afford to go such a campaign alone. We, you and Sprague, can help. So let's all pitch in—

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AND You'll never see the day when you can take your TV set in for a service

AND You'll never see the day when you can take your TV set in for a service "bargain" and be sure you're getting a square deal!

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The expert service technician, just like other professional people, must undergo years of study and apprenticeship to learn the fundamentals of his skill. And a minimum investment of from \$3000 to \$6000 per shop technician is required for the necessary equipment to test today's highly complex sets. Finally, through manufacturer's training courses and his own technical journals, he must keep up with changes that are developing as fast as they ever did in medicine, law, or dentistry. Those best equipped to apply modern scientific methods are almost certain to be

most economical for you and definitely more satisfactory in the long run.

Unfortunately, as in any business, there will always be a few fly-by-night operators. But patients, clients, and TV set owners who recognize that you get only what you pay for, will never get gypped. "There just ARE no service bargains"...but there is GOOD SERVICE awaiting you at FAIR PRICES!

Harry Malhar PRESIDENT

SPRAGUE PRODUCTS COMPANY North Adams, Mass.

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for Multiple



Cat. No. F-20 — MOSLEY 3-Way TV Antenna Switch

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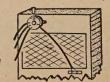
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marked by such defects as misregitration, line crawl, jitter, or unduprominent dot or other structure), o sufficient brightness so as to perm adequate contrast range, and capable of being viewed under normal hom conditions without objectionable flick

The ten committees, the petition de clared, were charged with the respor sibility of studying and reporting o the subjective aspects of color; colo transcriptions; color system analy sis; color video standards; color syr chronizing standards; receiver con patibility; field testing; broadcast sy: tems; coordination; and definition The standards group had quite an a signment, for they had to provide reommended standards relating to the complete video signal, which include the determination of both colorimetr and electronic specifications. Problem they had to resolve included camer taking and gamma characteristic color-carrier frequency and its phan relation with respect to horizont synchronizing signals; color sequence to be used and whether or not should be of an oscillating type; bans widths of the monochrome and coll signals; relative amplitudes of the monochrome signal and the color ca rier; maximum system amplitude d mands at critical colors to enable the determination of picture-to-synchrl nizing ratios; and specifications of t radiated signal.

Describing the nature and extent the work done by the field test paner the petition pointed out that o group, who had to test the performance of receivers, required the attetion of more than 100 engineers, we contributed more than 10,000 mm hours. Receivers tested were man by twelve manufacturers, and fi transmitters were used in a total a

seventeen field tests.

In a supporting petition, it w noted that the NTSC field tests. "establish that... with very f exceptions all existing black a white television receivers can equal or better black and white f tures from the NTSC signal than from the present black and white signal in addition, the brief added..." interference problems and broadcating service of existing broadcasts stations, with respect to black a white service, will be substantially be changed, in the event that the NTS signal is employed."

The brief also emphasized the f that the . . . "NTSC signal will of ate satisfactorily color receivers a will provide all the essential inforbation necessary for the satisfactor operation of color receivers throughout substantially the same servarea as black and white receivers."

Applauding the proposed standarthis petitioner said that the system now evolved . . . "represents soundest method, from a technique point of view, that is known at present state of the art." It seems likely, they added, that . . . "the standard of the control o

(Continued on page 165)

F. MICROPOTENTIOMETERS

By MYRON C. SELBY

National Bureau of Standards

ipment for production of accurate r.f.

nals in the 1 to 10^s microvolt range.

NDARD-VOLTAGE generators ve been used for many years to easure sensitivity and selectivity lio receivers, gain and frequency hse of amplifiers; they are also as field intensity reference standand for similar purposes where e values down to the order of a volt are required. However, reof measurements made with inial generators vary widely, the reement increasing progressively ncreasing frequency and decreasltage values. Thus, at 1-μν. levels, tainties of the order of 100% and r are frequently encountered and ments of 5% are rarely found, sularly when different types of ators are involved. Various comknown factors are responsible is difficulty. Among these, probthe most damaging are the unceres in the relative impedances of enerators and of the loads applied em. There seems to be a lack of ence in the condition of the genrs, leading to rugged, stable, and rather expensive structural res. This lack of confidence also sitates expert, laborious and costly ation procedures for attenuators oltmeters.

a result of this situation, there rolved a critical demand for a simulation of the supply r.f. microvoltages on a principle of operation ing a high degree of confidence in ecuracy. Two different types of a device which meet these requires, apparently in all respects, are abed below.

ple of Operation

basic principle of operation of icropotentiometer" is extremely e. A known current is fed into wn very low resistance, and the tial drop across the latter gives age which can be precisely calcu-Both the current and resistance in constant at all frequencies of tion. The frequency range exup into the u.h.f. region, and no ency corrections need be considered this range. The upper frequency

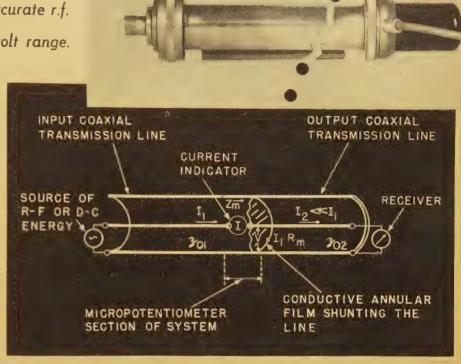


Fig. 1 (top). An over-all view of the coaxial type of micropotentiometer. Fig. 2 (bottom). Equivalent circuit of system using a micropotentiometer.

limit may be extended, but the top limiting frequency has not as yet been investigated. Resistance is of the order of 1 milliohm for the microvolt range and of the order of 10 to 100 milliohms for the millivolt range. Thus, for all practical purposes, the device is a constant voltage source; normally used loads will not affect its voltage output.

The above properties are obtained as a result of structural features. In the first type (see Fig. 2), the resistance proper consists of a metallic annular film a fraction of a thousandth of an inch thick (for the frequency range indicated). This thickness does not exceed one-half of the skin penetration for the given metal at the highest desired frequency. The resistance of the ring is given by:

$$R = \frac{\delta}{2\pi d} \ln \frac{r_1}{r_2} \text{ ohms} \qquad . \qquad . \qquad . \qquad (1)$$

where:

 $\delta = \text{resistivity}$, ohm cm.

d =thickness, cm.

 r_1 and $r_2 =$ large and small radii respectively

Figure 2 shows schematically a system which employs this type of micropotentiometer. The center conductor is actually much larger in diameter than

is indicated in the diagram. It can be shown that an annular element of the above structure located in a plane normal to the conductors of a coaxial transmission line is essentially equivalent to a pure shunt resistance over the entire frequency range specified. Thermoelements, thermocouples, thermistors and other types of bolometers may be used as current indicators which are independent of frequency within the given range. The micropotentiometer proper comprises a part of the system shown. A source of r.f. feeds energy to the annular ring through a transmission line and another line supplies the standard voltage to a receiver or any other monitor. This latter line is an integral part of the receiver and is physically connected and disconnected as close as possible to the annular resistor. In practice, the input impedance looking into this line is very high compared with the annular resistance, and therefore has no loading effect upon it. D.C. energy may be substituted for r.f., and either the current or the d.c. resistance of the ring or both may be measured. The d.c. output voltage (across the ring) could be measured or calibrated as a function of the

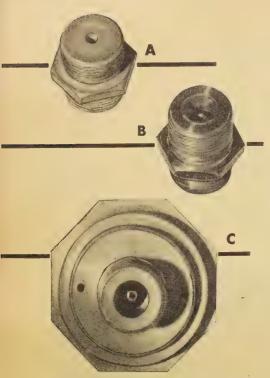
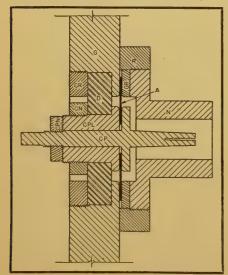


Fig. 3. (A) and (B) are solid resistance elements for a micropotentiometer, and (C) is a clamped type resistance element.

current monitor indications; however, this would be rather difficult to do in the microvolt range at d.c., whereas the resistance can be measured separately.

The voltage range of a single resistive element is limited by the range of the current indicators. For example, thermoelements may be used for currents of 2 to 200 ma. at frequencies to 300 mc. and higher. Thus, a voltage range of 100 to 1 may be available with one resistance element and interchangeable thermoelements. For frequencies up to several megacycles, this range is about 1000 to 1 due to the wider range of thermoelements available. Though there is evidence that the resistance elements will carry currents

Fig. 4. Cross section of clamped type of interchangeable element assembly.



up to 1 ampere, it seems more practical to expand the range further by using several elements of different resistance values rather than by increasing the current. The reasons for this are: (1) the power dissipated in the annular film increases as the square of the current and only as the first power of its resistance, (2) it is increasingly difficult to obtain higher current-carrying monitors which are insensitive to frequency, (3) it is somewhat more difficult to obtain higher currents from conventional sources of r.f., and (4) it may prove more economical to increase the number of resistance elements rather than the number of current monitors.

In general, this micropotentiometer can be made very flexible by having both interchangeable current indicators and interchangeable resistance elements. The resistance range is controllable primarily by the conductivity of the film; it can also be varied within narrow limits by varying the ratio of r_1 to r_2 (Eqt. 1). For lower frequencies the thickness of the film provides another parameter controlling the resistance of the ring, but for a maximum frequency range the thickness should not exceed 50% of the skin penetration, as already pointed out. This places a minimum on the resistance value obtainable with a given metal; higher resistances may be obtained with thinner films of the same metal. Thickness of the film can be decreased to a point at which the film no longer behaves like a solid metal (down to about 50 millimicrons). The complete assembly of a micropotentiometer employing a thermoelement appears in Fig. 7 together with a schematic equivalent of the components.

The "coaxial" type of micropotentiometer, differing only in the basic manner of monitoring the current, is shown schematically in Fig. 5. This unit consists of a length of solid, uniform transmission line having negligible losses; the dielectric may be air or any other conventional solid insulator. The line is terminated by a solid shorting disc having an annular section in accordance with the above requirements. Instead of measuring the current entering the annulus, as is done in the type just discussed, the input voltage into the line section is measured. Under these conditions, to a very good approximation:

$$V_{\bullet} = I_r Z_0 \sin \beta_0 l \ldots \qquad (2)$$

$$V_r = I_r R_r = V_* \frac{R_r}{Z_0} \csc \beta_0 l$$

$$= V_* K_1 \csc K_2 f (3)$$
where:

 $R_r = \text{resistance of annulus, ohms}$ V_r and $V_s = \text{output and input voltages,}$ respectively, volts

 $I_r = \text{current}$ in the short, amperes $Z_0 = \text{characteristic}$ impedance, ohms

 $\beta_0 = 2\pi/\lambda = \text{phase constant of line}$

 $\lambda_0 =$ wavelength of line

l = length of line, meters

f =frequency, cps

Since K_1 and K_2 are both constant for a given air or solid dielectric line one can plot V_r vs. frequency for V_r ? 1 volt to facilitate the determination V_r over wide continuous frequency a voltage ranges. This type of microp tentiometer can be conveniently use at check frequencies for which the lines an odd multiple of $\lambda_0/4$, where:

An examination of a cosecant pl will show that a ten to one and large frequency range is obtainable witht single line section. However, the "c axial" micropotentiometer does not had the continuous wide range and flexib ity of the first type. Two other shop comings are: (1) lower accuracy as: result of the limited accuracy of vor meters, and (2) relatively large phyr cal dimensions. On the other han this type offers very attractive fe tures where practicability is of print consequence. One advantage is the vacuum-tube voltmeters of 10 or 20: accuracy are commonly available; crovoltages of such accuracy are usual satisfactory for many purposes. Anon er advantage is the elimination of the rather fragile thermoelements a bolometers. A third advantage is the je tential availability of fractions of r crovolts at higher frequencies; crystrectifier type voltmeters may be e ployed down to 10 mv. and lower r stead of vacuum-tube voltmeters having a usual bottom limit of 100 mv. A p tograph of a coaxial type micropote tiometer is shown in Fig. 1.

Design Features

The design of practical micropote tiometers depends to a large degree the current-monitoring means, top in quency and voltage range desired. Louise of thermoelements requires termals for the d.c. output whereas a use of bolometers or of direct couprequires either r.f. chokes or block capacitors, or both. This discussional limited to units employing there elements.

Frequency and voltage ranges gove the design of the resistance element. The resistance element is the comment of the micropotentiometer sembly which incorporates the anilar resistive film. It will be appart that no separate component is necessary, that the film can be made integral part of the entire metas shielding enclosure, that the latter rindeed be preferable to reduce the sibility of leakage and radiation, that replaceable units are advising primarily as an economic expedients.

rent kinds of replaceable resistlements are shown in cross sec-Figs. 4 and 6. Figure 6 shows odifications of a solid structure he annular film closely bonded coaxial conductors as well as to parating dielectric. The latter glass or ceramic, and the elecare most conveniently made out ss. Kovar-glass sealed terminals e used when properly protected t oxidation. A metallic film is ed over the cylindrical surface e of the end surfaces of the ing glass or ceramic bushing by burned on or by means of evapand plating; the assembly is pldered along the cylindrical surto one solid unit, allowing the the end to serve as the annular r. The annulus should be located e as possible to both the current r and to the output plane of the otentiometer, i.e., the resistance t should be as short as possible. distances to the current monitor sult in errors due to the presence rent standing waves. Long disto the output plane will result ors due to impedance transformay the output line section. Forly, both errors are potentially (at frequencies up to 300 mega-For higher frequencies, the sible unit (Fig. 6A) can be used he annulus at the output plane; emistor as a current indicator will the current distribution error in ase. Figure 6B shows a unit emcommercial Kovar-glass terminal. Both units represent designs suitable for low resistrelements (1 to 100 milliohms) hoble metal films.

ther kind of resistance element, Fig. 4), makes use of meal clamping of threaded mem-This structure has been successfar only for relatively high rece values (of the order of 1 ohm). suseful as a source of accurate es in the millivolt range. Carbon resistance elements may be employed in this case. High resistance elements should be equally easy to obtain with the type of construction shown in Fig. 6; however, the clamped structure is of value where no facilities for film deposition are available. Figures 3A and 3B are photographs of solid resistance elements, and Fig. 3C is a clamped type

Verification of performance of both types of micropotentiometers was obtained in terms of a standardizingvoltage bolometer bridge' and precision piston attenuators. Agreements were well within over-all experimental errors, i.e., $\pm 1\%$ to about 50 mc. and ±3% to 300 mc. Measurements at higher frequencies have been conducted so far only on the clamped 1-ohm units and have resulted in agreements of $\pm 5\%$ to 900 mc.

As indicated, the primary objective of a micropotentiometer is to provide accurate voltages for checking standard-voltage generators; and it may also be used directly as a standard-voltage generator. In addition, it is useful in many other applications: (1) voltmeter calibration, (2) calibration of attenuators directly in terms of voltage ratio, (3) determination of current indicator characteristics, (4) determination of output impedances of r.f. sources and circuit networks, (5) calibration of modulation meters—this application being common to all devices employing thermoelements and bolometers with an accurately known correlation of c.w. and modulated power, (6) applications where known voltages in the microvolt range are desired without the usual thermal (Johnson) noise of higher impedance sources present, (7) applications where constant voltage sources are required, e.g., Q-measurement circuitry, (8) applications where a single device to cover the entire frequency range from zero to 300 mc. and higher is essential.

Micropotentiometers are particularly suitable for improvising sources of

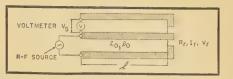


Fig. 5. Schematic representation of coaxial type of micropotentiometer.

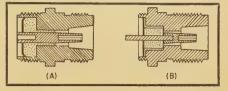


Fig. 6. Cross sections of two types of interchangeable resistance elements.

accurate voltages having any desired source impedances. One needs simply to introduce these desired impedances in the output coaxial connector, and fixed output impedance sources may be standardized and reproduced at will. A standard "dummy antenna" may be used for this purpose with the additional certainty that high internal source impedance commonly encountered in conventional signal generators will not alter the effective impedance of the antenna.

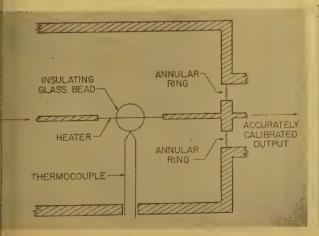
Another application of interest is the standardization of balanced voltages. At lower frequencies, two individual micropotentiometers may be combined and fed from a balanced secondary of a transformer: the amplitude of each half to ground may be readily equalized. At higher frequencies, a single enclosure with two annular elements may be constructed to feed a balanced output twinax termination.

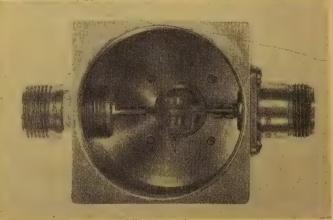
REFERENCES:

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Fig. 7. Photograph and schematic equivalent of a micropotentiometer using a thermoelement as a current indicator.







Low-distortion, wide-range, automatic gain-riding circuit for unattended remote broadcasting service.

ROPER program level control for unattended remote broadcasting (in which there is no operator at the remote point) is a problem common to most broadcast stations. Many studio operators are thoroughly familiar with the grating distortion of an overloaded remote amplifier and the usual inability to reach the announcer at the remote point in order to have the gain reduced. This is especially true of long line broadcasting in which intervening oneway telephone repeaters are used. And these repeaters, like any other amplifiers, will contribute their share of distortion when overdriven by a free-running remote amplifier.

Station KHUZ carries the out-oftown games of local baseball, football and basketball teams by means of long line remotes, with an announcer at the broadcasting point only. It has not been feasible economically for this station to send an operator to each of these sports events, and consequently many of the broadcasts have been of unnecessarily poor quality due to overloading of remote and telephone company equipment.

The difficulty with these remotes has now been overcome quite satisfactorily by the incorporation of an automatic gain-riding circuit within the remote amplifier used for these broadcasts. The circuit is capable of a wide range of attenuation with low distortion and can be readily wired into many existing remote amplifiers.

In this case, the amplifier selected to accompany the circuit was a singlechannel Raytheon Model RR-10, which readily lends itself to the gain-riding modification with a minimum disturbance of the original wiring and other components. With this amplifier, the cutting of an additional tube socket hole for the (6H6) audio rectifier may be eliminated by substituting a pad not of the plug-in type and using the socket that formerly held the amplifier's 5-db plug-in line isolation pad. Little is lost by using this socket since the attenuation of the pad must be increased to accommodate the necessary increase in

output level of the amplifier for the gain-riding modification.

The gain-riding circuit for the RR or a similar amplifier can be wired about two hours. For the RR-10, adapter plate to fit a 1-ma. meter which may be calibrated in db of co pression-will have to be cut to cor the larger meter hole remaining wi the amplifier's original vu meter eliminated. In the event that a static present remote equipment is unsafactory for the gain-riding modifition, the time and effort needed. construct a composite amplifier around the gain-riding circuit will be

For the amplifier's compression cuit, a 6K7 triode-connected tube chosen to replace the original triode that formed the second stage the RR-10 amplifier. The 6K7 tric connected tube was selected because plate current vs. grid bias characte istic was found to be reasonably ponential and capable of a compress ratio of 20:4.75 db with low distortic

Measurements have borne out fact that compression of the in signal to the amplifier may vary fi 0 to 15 db and effect a distortion: in the amplifier's line output of than 1%. This range of attenual exceeds the range necessary to cont any normal broadcast.

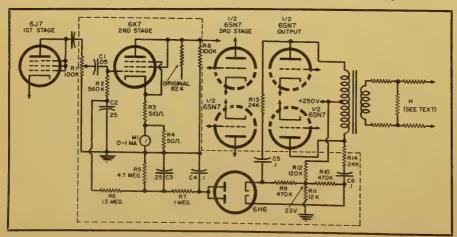
With the 6K7 attenuator tube were ing single-ended, it is necessary to be filter constants following the at rectifier (6H6) that are comparative slow. Otherwise, unpleasant thun will appear in the output of i amplifier during compression. The essary delay in the filter has little ef on the gain-riding ability of the ame fier. Comparing the attenuator in act practice with an operator, it has to proven that the attack time is s that the attenuator will reduce an o load and restore the gain to nor as effectively as would an opera manually riding gain on the sa broadcast.

Release time governed by $R_{\rm b}$ chosen to prevent a churning effect high compression levels, particularly voice, and to permit a continuous reduction of 2-3 db for average program material. This allows tremely low level program passa of long duration to be raised in amplifier's output by a similar amo

Resistor R₈, between the attenua tube plate and ground, is rather of the ordinary. R_8 , in relation to 6K7 attenuator tube, affects the c pression ratio in db by (20:7.25) (20:4.75); i. e., inclusion of R_8 perp

(Continued on page 27)

Circuit modifications for automatic gain control applied to Raytheon amplifier.



^{*}From the point where gain reduction st an input signal increase of 20 db will pro an output signal increase of 4.75 db.

NGLE-SIDEBAND TRANSMISSION

Ву

ROBERT C. MOSES

Lear, Inc.

OUGH the basic principles of cle-sideband suppressed-carrier (ISC) transmission have been nown for more than two decades, cently only very limited applicabeen made of this technique, in point-to-point communications 4. It is just within the past few that SSSC has begun to receive tention it merits. Widespread a system which can be shown b several very real advantages inventional double-sideband AM bably been in part curtailed by ortcomings of existing receiving dent; however, recent improvein the latter open the way to creasing application of the SSSC f of transmission.

I of this series draws a direct cison between single-sideband seed-carrier and double-sideband ansmission systems from both lical and practical standpoints, resents the basic principles governeration and amplification of SC signal. Part II will be conprimarily with the design of the circuits peculiar to SSSC of transmission, and will incomplete description of a 600-ingle-sideband transmitter of the lift type.

arison of AM and SSSC

nusoidal carrier of amplitude 1 frequency $\omega/2\pi$, amplitudeted by a sinusoidal audio comof single frequency $a/2\pi$, may ressed by:

 $(1+m\sin at)\sin \omega t$. . (1) is the instantaneous amplitude modulated wave and m is the of modulation. The reference f the carrier has been neglected applicity. A Fourier-series exof Eqt. (1) yields:

$$\sin \omega t + \frac{m}{2} \sin (\omega + a) t$$

$$\sin (\omega - a) t] \qquad . \qquad . \qquad . \qquad . \qquad . \qquad (2)$$

In the terms $(\omega + a)$ and $(\omega - a)$ in the upper and lower sidebands wely. With 100% modulation, the two sideband components oltage or current amplitudes that of the carrier; the power



Part 1 of a two-part article discusses SSSC theory and generation by filter and phase-shift systems.

in each sideband under these conditions is therefore one-fourth that in the carrier. In a linear modulation system, the average amplitude of the carrier component, E_{\circ} sin ωt , is constant regardless of the instantaneous value of m; the sideband energy may be thought of as being developed by the modulator. Consequently, for 100% sine-wave modulation, the modulator must generate 50% of the average power represented by the carrier alone.

The sideband components:

 E_{\circ} [(m/2) $\sin (\omega + a)t$] E_{\circ} [(m/2) $\sin (\omega - a)t$]

are symmetrically displaced $a/2\pi$ in frequency on either side of the carrier. When both are demodulated simultaneously against the carrier, large with respect to the peak sideband amplitude, the phase relationships are such that the modulation frequency $a/2\pi$ is recovered without distortion. Since the difference frequencies $\omega - (\omega + a)$ and $\omega - (\omega - a)$ are the same except in phase, the intelligence represented by each is identical. It is not necessary, therefore, to transmit both sidebands; insofar as the effect at the demodulator of the receiver is concerned, the recovered audio waveform will be the same except in amplitude whether or not both of the sideband components are present.

Demodulation of a double-sideband AM signal in a linear detector, without excessive distortion, requires that the peak-carrier to peak-sideband ampli-

tude ratio be at least unity; the waveform of the recovered audio components will be substantially altered if the instantaneous amplitude of either sideband appreciably exceeds that of the carrier*. It is not essential, however, that the carrier against which the sidebands are demodulated be the same signal as is generated initially at the transmitter; if a large amplitude local carrier is injected into the receiver. exactly the same conditions as described will prevail at the demodulator, provided that the locally generated carrier maintains precisely the same frequency and phase relative to the two sidebands as does the transmitted carrier. If the amplitude of the locally generated carrier is many times greater than the peak sideband amplitude, and phase and frequency synchronism is maintained, exalted-carrier reception with synchronous detection will result1.

While in theory it would be possible to eliminate the transmitted carrier completely and resupply it at the receiver, for demodulation of double-side-band signals the practical difficulty of maintaining exact phase and frequency relationship between the transmitted sidebands and the locally generated carrier makes it necessary to transmit at least a "pilot" carrier, somewhat reduced in amplitude, for control of the

^{*}If the two signals have the same amplitude, the demodulated output will contain 20% second harmonic.

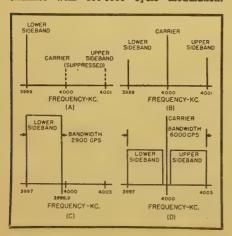


The "Sideband Slicer," a receiver adapter which utilizes the phase-shift principle to provide selectable single-sideband reception of SSB, AM, PM and c.w. signals.

receiver local oscillator. If only one of the sidebands normally produced in the modulation process is transmitted, however, exact phase and frequency synchronism between the locally generated and transmitted carriers is no longer necessary. The transmitted carrier can then be completely suppressed and resupplied at the receiver without too much difficulty. Experience has shown that the local carrier may be as much as 30 cycles removed from its correct frequency before the intelligibility of the received single-sideband suppressed-carrier signal is appreciably impaired.

A line spectrum of such an SSSC signal is shown in Fig. 1A for a 4000-kc. carrier and a 1000-cycle modulating signal, with the carrier and upper sideband completely suppressed. The corresponding double-sideband AM sig-

Fig. 1. (A) Line spectrum of SSSC signal.
(B) Line spectrum of double-sideband AM signal. (C) SSSC channel with 100-3000 cycle modulation. (D) Double-sideband AM channel with 100-3000 cycle modulation.



nal appears in Fig. 1B for comparison. The lower sideband of the SSSC signal is represented by:

 $e_s = kmE_o[\sin(\omega - a)t]$. . . (3) neglecting phase, where k is a constant less than unity determined by the type of modulation employed.

For a fixed-frequency modulating signal $a/2\pi$, the SSSC signal is a pure r.f. component of frequency $(\omega - a)/2\pi$ and amplitude kmE. The modulation envelope, characteristic of the corresponding AM signal, is not present. If the modulating signal consists of a band of audio frequencies $\Delta a/2\pi$, ranging from say 100 to 3000 cps, the corresponding r.f. components are $(\omega - \Delta a)/2\pi$, having instantaneous amplitudes exactly proportional to the instantaneous amplitudes of the individual modulating components. These individual components may be thought of as having "moved upstairs," while still retaining their original frequency relationships to each other, as shown in Fig. 1C. The spectrum of the corresponding double-sideband AM signal is shown in Fig. 1D.

The effective communication channelwidth occupied by the SSSC signal extends from 3997 to 3999.9 kc., exactly the bandwidth Δa of the original modulation components. On the other hand, the channel-width of the doublesideband AM signal is slightly over twice the bandwidth of the modulating signal. The single-sideband signal, therefore, is far more conservative of spectrum space, since it takes up only the bandwidth required for transmission of those sideband components necessary to intelligence. By the same token, the energy content represented by the intelligence-carrying sideband components is concentrated into an r.f. band having slightly less than one-half the width of that required by the corresponding AM signal; hence, for an equivalent sideband power, the SSSC signal is at least 3 db more effective. The 3-db gain is greatly enhanced by the attendant reduction in necessary receiver bandwidth and resultant improvement in over-all signal-to-noise

A further and very real improvement in over-all efficiency as compared with double-sideband plus carrier transmission becomes apparent when it is realized that the power represented by the carrier—which itself is equivalent to twice the total sideband power and does not contribute intelligence—is now placed in one sideband. For a given transmitter power capability, elimination of the carrier results in a theoretical gain of 4.8 db; practically, this is nearer 6 to 7 db because the peak sideband power—when integrated over many audio cycles—seldom approaches

50% of carrier conditions with a voice modulation. The net improvement in communication effectiveness of SS over double-sideband AM, all factor considered, may be as much as 9 to db. Using a given tube or pair of tulin the final r.f. amplifier, this mer that the effective power output w SSSC transmission will approach 8 10 times that attainable with convitional AM.

Generation of SSSC Signal

Two methods of developing a sing sideband suppressed-carrier sign known respectively as the filter systy and the phase-shift system, are in great use. Although basically difference each is capable of good over-all diciency and linearity, and both provide 9-10 db effective gain over an attransmitter of equivalent power cabilities. By the same token, a system has its own advantages shortcomings when placed on a caparative basis.

Filter System

The filter system depends upon g eration at low level of a double-sideb. AM signal with carrier suppresse and upon subsequent filtering to reme the undesired sideband componer The resulting SSSC signal, which is necessity at a relatively low ra frequency, is then remodulated u a high frequency carrier, filtered ag: to remove this carrier and the s desired products of the second mode tion, and amplified at the final of ating frequency in one or more lirl r.f. amplifiers. A block diagram o typical filter system, designed operation at 4.0 mc., is shown Fig. 3.

A low-frequency double-sideband nal having components:

 $kmE_c \sin (\omega_1 - a) t$ $kmE_c \sin (\omega_1 + a) t$

—the lower and upper sidebands generated in a balanced modulator a level of a few volts. Phase relationships herein are such that the circle balanced for any carrier components is balanced for any carrier component and the sidebands only appear at a modulator output. The modulator impedance is designed to be very sifter the modulating frequency a and relatively large for the sidebands, of examplitude, are passed on to the lowing filter network.

It is impractical to design a side filter having the required attenual characteristics for operation at frequencies above about 500 kc.; at this low a frequency, the filter retake the form of a complex lattice work or equivalent utilizing very large at the rejection of ed sideband is to exceed 20 db Generation of the single sideherefore, must be accomplished y at a relatively low r.f., and ently heterodyned to the final ng frequency. In a properly deand constructed 460-kc. lattice using quartz crystal reactive ts, the attenuation of the unsideband may exceed 35 db over eful range. Figure 2 shows the ission characteristics vs. freof a typical crystal-lattice filter ed for transmission of the lower d. Several variations of the latnfiguration are in use.

use any form of frequency ier would destroy the frequency nship between the individual id components, the single-sideuppressed-carrier signal at the of the sideband filter is heteroto the final output frequency in r or frequency converter similar t used in receiver applications. ed operation of the mixer stage necessary unless the frequencies original sideband $(\omega_1 - a)$ and erodyning oscillator ω2 are quite ogether, as in the conversion of cc. sideband to 14 mc.; in such rejection of the oscillator signal mple bandpass filter may be dif-Balanced mixers are also frer used in cases where appreciable power is required for the grids Ifollowing stage. The upper and cideband components $\omega_2 + (\omega_1 - a)$ - $(\omega_1 - a)$ of the remodulation are separated in a second filter may be a relatively simple , and the final SSSC signal at verating frequency is built up to cired power level in one or more r.f. amplifiers.

filter method of generating an signal is straightforward and noncritical (except possibly for design and adjustment of the d filter). Consequently, it is ely easy to adjust for optimum ed sideband suppression, and at up, will retain its adjustment g periods of time. On the other is the system requires at least terodyning process in order to tat the final operating frequency, need more stages than a phasewstem of equivalent power cap-As. Also, the filter system generalplves some special components, martz crystals or high-Q rein the sideband filter, and thereay prove to be somewhat more Selection of either sideband is usually very difficult with a gilter.

Shift System

aphase-shift or phasing method

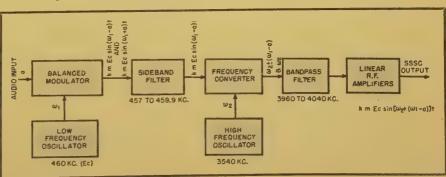
of developing an SSSC signal is based upon the phase relations between the carrier and its sidebands in an amplitude-modulated wave.

Referring to the block diagram of Fig. 5, a carrier E. which can be at the operating frequency—is generated at low level in a stable oscillator and split into two equal components. One of these, $E_o \angle 0^\circ$, is applied directly to balanced modulator A. The other carrier component, $E_{\circ} \angle 90^{\circ}$, is rotated in phase by 90° in a suitable r.f. phaseshift network and applied to balanced modulator B. Audio signal Ea is also split into two equal components having a 90° phase relationship, and quadrature voltages $E_{\circ} \angle 0^{\circ}$ $E_{a} \angle 90^{\circ}$ (or 270°) are applied to the appropriate balanced modulator. The individual carriers are cancelled in the balanced modulators, whereas the sideband outputs of the latter are combined in an adding network. The resulting SSSC signal is then amplified to the desired power level in one or more r.f. linear amplifiers. Adjustments are provided within the system to permit equalizing the individual carrier and modulating voltages and effective modulation factors; further adjustments achieve the necessary 90° carrier and audio phase relationships at each mod-

The mechanics whereby a singlesideband output is produced in the phase-shift system can be mathematically analyzed as follows:

If E_A and E_B are the output voltages of modulators A and B respectively, E_{σ} is the carrier voltage applied in quadrature to both, $\omega/2\pi$ and $a/2\pi$ are the carrier and modulating frequencies, and m_1 and m_2 the modulation factors, then:

Fig. 3. Block diagram of a typical filter system for SSSC transmission.



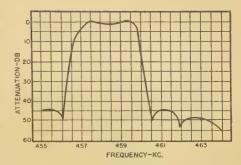


Fig. 2. Typical sideband filter transmission characteristics.

If $m_1 = m_2 = m$, Eqt. (4A) becomes simply:

 $E_A + E_B = kmE_c \cos(\omega - a)t.$ which contains only the lower sideband. Shifting the phase of E_B through 180°

$$E_A - E_B = -kmE_c\cos(\omega + a)t$$
 . (4C) —the upper sideband.

Equation (4A) illustrates the necessity of maintaining exact 90° phase relationships throughout the system as well as equal values of m_1 and m_2 ; departures from quadrature phase relations in either carrier or audio components, or inequality of the respective modulation factors, will lead to incomplete cancellation of the undesired sideband. It can be shown that the undesired sideband attenuation for a small departure ø from 90° audio or r.f. phase relationship is very nearly:

Atten. (db)
$$\approx 20 \log_{10} \frac{1}{\sin \phi}$$
 . . (5)

where $\emptyset \leq 10^{\circ}$, and the amplitudes of the sine and cosine components are equal $(m_1 = m_2)$. The effect of amplitude differences upon sideband rejection is given in Eqt. (6), where correct phase relationships are maintained:

Atten. (db) = 20
$$\log_{10} \frac{m_1}{m_1 - m_2}$$
 . (6)

where m_1 and m_2 are the effective modulation factors, and $m_1 \ge m_2$. The amplitude ratio of desired to undesired sideband output as a function of phase and amplitude disparities is plotted in Fig. 4.

The undesired sideband attenuation

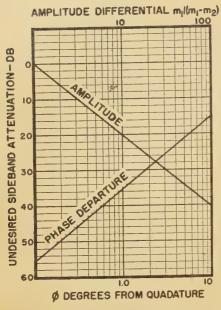


Fig. 4. Undesired sideband attenuation vs. amplitude and phase-angle departure in degrees from quadrature.

obtained in a properly adjusted phaseshift system is a direct function of the extent to which the audio phase-shifting network maintains the required 90° phase relation and output voltage equality over the frequency range of interest. While infinite rejection of the undesired sideband is theoretically possible, the practical difficulty of holding exact quadrature phase relationship and equal amplitudes between the audio components usually restricts the average attenuation to the order of 35-40 db over the range from 100 to 3000 cps. Audio phase-shift networks capable of providing this order of performance have been designed *, * and usually consist of appropriate RC lattice networks or cascaded 90° lead-lag networks staggered at specific frequencies within the operating range.

With proper design and adjustment, the phase-shift method of SSSC generation is capable of providing a degree of suppression of the undesired sideband at least as good as that of an equivalent filter system. It is apt to be somewhat less complicated than the latter, equipmentwise, in that development of the single sideband may take place directly at the operating frequency. For fixed-frequency operation, intermediate heterodyning processes are not necessary; hence, fewer stages will be needed. At the same time, no special components are required; the design will in most cases prove less costly than a filter system of the same power capability. The phase-shift system also lends itself without additional complication to operation on either sideband at will, as well as to generation of double-sideband AM and phase modulation with carrier reinserted. On the other hand, adjustment of the phase-shift system for optimum performance is apt to be somewhat more difficult and will usually require additional test equipment. By the same token, the phase-shift system is inherently less stable in adjustment over extended periods of time, and will generally demand more frequent attention if the maximum capabilities of the system are to be maintained.

Amplification of SSSC Signals

As the previous analyses have shown, an SSSC signal generated by either the filter or phase-shift method consists of a single r.f. component kmE. sin $(\omega \pm a)t$. The amplitude of this component, insofar as the modulating signal is concerned, varies directly and linearly with m; consequently, any amplifiers required to handle the SSSC signal must display a linear relationship between grid exciting voltage and a.c. load current. Departure from linearity in an r.f. amplifier for SSSC applications will result in generation of spurious distortion products and create sideband components on the side that was suppressed in the exciter.

Linear amplifiers for SSSC have direct counterparts in amplifiers designed for a.f. applications. Tubes designed for audio work will operate in linear amplifiers at substantially same power output and efficient provided of course that the tubes w function properly at r.f. In comm with audio system designs, class A AB, stages are useful in the 2-15 we power output range; for improve efficiency, class AB2 and class B amp fiers find application at higher pow levels. Because an r.f. linear amplifis a single-frequency affair, tuned put and output circuits having mode ately high Q's are employed; in e trast to the audio case, therefore, pur pull operation of a class B line amplifier is not essential.

As the factors governing design and adjustment of an r.f. linear amplificate equivalent in many respects: those of conventional audio practice detailed treatment is not necessary here. Calculations of peak power of put, efficiency, optimum load importance, grid-driving signal levels, at tube operating conditions are carrout according to the usual procedual

The maximum-signal efficiency to expected in a properly adjusted cl B linear amplifier is of the order 60-70%, with an effective power g of between 12 and 15 db. In class A and class AB₂ systems, the efficient is somewhat lower, 35-50% being to ical. On the other hand, the power g becomes much larger, reaching valas high as 40 db for amplifiers or ated without grid current. Since line ity of the system is generally bet as the operation tends more town straight class A, this class of amplic is frequently used in low-level star where power efficiency is not a proble

With either type of SSSC generates the audio requirements are completed independent of the final r.f. power less of the transmitter; an effective at power of less than two watts is sificient to drive virtually any low-less balanced modulator. Consequently, y SSSC transmitter represents a considerable saving in the audio end of system over an equivalent AM trainmitter. This is particularly true higher r.f. power levels, where a audio requirements of the latter, mand the use of large tubes and connents.

Operating Characteristics

Apart from the improvement in comunication effectiveness of singlesband suppressed-carrier over douslideband AM, SSSC features cereoperating advantages with regard cochannel and adjacent-channel in ference, fading, and effects of noise atmospheric disturbances. These vantages become most apparent with the SSSC signal is received on second (Continued on page 29)

AUDIO INPUT Ea MODUL ATOR m, Ec (sin Wt sin at) PHASE Ec sin wt R.F. LINEAR AMPLIFIER(S) SSSC OUTPUT k m Ec cos(Wta)t 90° AUDIO Edicos Wt cos att ODULATOR NETWORK В Fc cos W Fig. 5. Block diagram 90° R.F. CARRIER of phase-shift system for SSSC transmission. Εc

IRTICALLY POLARIZED ICROWAVE ANTENNA

By

R. K. THOMAS and M. E. RINGENBACH

Bendix Radio Div., Bendix Aviation Corporation

Design details and performance of a microwave antenna giving a specific radiation pattern.

antenna to be described below developed to meet specifications th required a fan-shaped beam in the vertical dimension. Polarwas to be vertical, and physical zions were such that the weight ce of the antenna were to be kept all as possible. Consideration of 1st item led to the choice of rigid al line as a structural basis, rather the bulkier and heavier wave The desired frequency band was that a stub-supported line could ected as being satisfactory elecsy and mechanically, as well as à obtainable.

r simplest form of radiating eletion was deemed to be a series ut part of the way around the deference of the line. Since no inprobing of the line was contemtor, there would be no mechanism for veversal, and the elements would, ce, be situated at one wavelength ag along the array. It thus became

7. 2. (A) Side view and (B) top w showing antenna construction.



necessary to provide means for holding the phase front reasonably flat in order to avoid the existence of undesirably large side lobes. This was readily accomplished by tying the slot edges together at their centers with V-shaped metal struts, as indicated in Fig. 2. which is a sketch of the rudimentary antenna structure. The structure then becomes equivalent to a vertical slice of an array of small horns, although the aperture length was made 4\(\lambda\) in order to secure the required degree of directivity in the vertical plane. Figure 3 shows the corresponding E-plane pattern for such a configuration: the resulting maximum side lobe of 12-db intensity below the main beam, which is only slightly greater than that which would be obtained from a uniformly illuminated array, was satisfactory for the required application. No beam tilt or pattern degradation was observed throughout the required frequency band.

In order to control the horizontal beamwidth, the struts were connected to metal sectors as shown in Fig. 2. These sectors permit the electric field to spread around in azimuth, leading to the H-plane pattern shown in Fig. 3. (If the slots are joined to the sectors by conical segments instead of thin struts, the azimuthal beamwidths obtainable will be almost directly proportional to the sector angle over a fairly wide range.) Cross-polarization properties are satisfactory, the undesired polarization being at least 20 db down in all cases measured.

Knowing the number of elements which would be required to give the desired vertical directivity—four in this case—it next became necessary to investigate the impedance properties of an individual element, as well as the mutual impedance between such elements, in order to match the array to

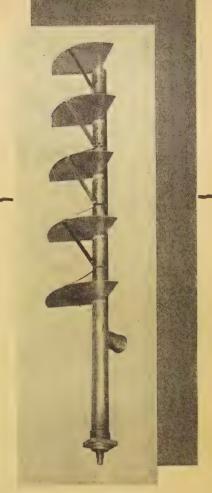
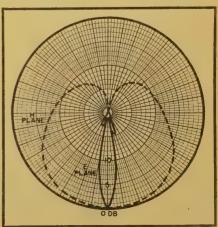


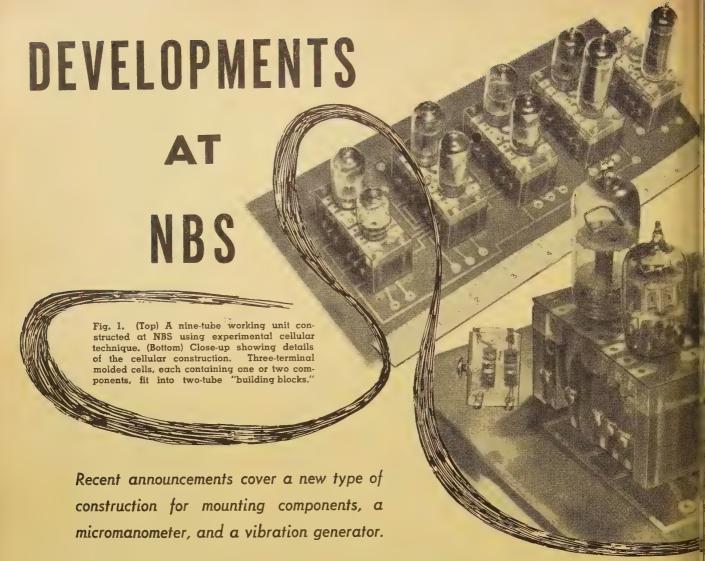
Fig. 1. The coaxial vertically stacked array.

the feed line satisfactorily. The technique involved in making such measurements was to terminate the antenna in a matched load in order to eliminate any unknowns introduced by short-circuited sections of line, and then subtract this series load from the resulting impedance measurement to arrive at the correct value for the antenna itself. This investigation showed that the mutual impedance between adjacent elements is quite low and can be neglected when the element spacing is 1λ .

(Continued on page 27)

Fig. 3. E-plane and H-plane pattern. Half-power beamwidths are 13° for the E plane and 112° for the H plane.





NTEREST IN electronics is high at the National Bureau of Standards, judging from the continual flow of information released by this organization. The following report describes three developments on which information has been made available.

"Cellular" Construction

Printed electronic circuits in which conducting patterns etched on plastics take the place of conventional wiring have come into fairly wide use, and several solutions have been offered to the problem of connecting components and tubes to the printed sheets. However, the diversity of these solutions and their inability to gain widespread acceptance would seem to indicate that the optimum answer has not yet been found.

In a novel approach to the problem currently being investigated by NBS, small three-contact molded blocks or cells—each containing one or two circuit elements (resistors, capacitors, or inductors)—are pressed against the etched circuit pattern by means of springs which are extensions of the tube socket contacts. No soldering is needed. This experimental technique is one of a number being studied at the

Bureau in a program for improving construction and maintenance of electronic equipment which is sponsored by the Navy Bureau of Aeronautics. Proposed by Dr. P. J. Selgin of the NBS Engineering Electronics Laboratory, the cellular assembly method has several interesting features that could prove advantageous. See Fig. 1.

Individual molded cells are about %" high by 1/2" wide by 1/4" thick. Each has three contacts, one on the top and two on the bottom. The cells are grouped together in "building blocks," each of which comprises two tubes and twelve cells held in a compact bundle by means of a suitable frame. The top surface of each block consists of a spring assembly containing the tube sockets and the necessary spring contacts. When the block is fastened to the printed base plate by means of screws. springs in the spring assembly apply substantial pressure to the top terminal of each cell and hold the two bottom terminals firmly in contact with the printed circuit pattern. Positive and noise-free electrical connection is further assured by the application of a thin film of grease to the cell contacts.

The two-tube block is considered an optimum-sized subassembly in the NBS

system. Any number of the blocks capbe mounted on a suitably printed has plate of sufficient area. Potentially is expensive, they are compact (about 2¼" x 1" x 1¾", exclusive of tubes and are easy to store and to handle They are also extremely rugged; a long as a block is secured to the base plate, none of the cells can vibrate exhake loose.

One noteworthy feature of this tecknique is the quick replaceability of boldblocks and cells without the use plugs or connectors. If conventions "plug-in" assemblies were made small as the blocks, the plugs would as substantially to both size and cost Elimination of both soldering labor as multiple connectors results in a doubt saving.

In case of trouble, an entire blod can be easily removed for repair or replacement, simply by loosening to screws that hold it to the base plate Either on the spot or after return the factory or service laboratory, dective blocks can be quickly repair by replacing faulty cells. Each cell identified by suitable markings.

An important aspect of the use three-terminal cells is the fact the positive pressure can be maintained

oints, and only three points, by le spring. Fortunately, in the najority of electronic circuits, no han two circuit elements need be ted electrically to a single tube de. A three-terminal cell, thereesides being easy to hold under pring pressure, will in general enough electrical contacts for ments associated with any tube xceptional cases can be handled ans of a spare cell which is not ted to the tube pins. It is also e to provide three-terminal cells ble or triple the standard thickb accommodate occasional overelements.

practical possibilities of this of construction would appear to firmed by an experimental ninecellular circuit which has already constructed at the Bureau. For lience, a casting resin was used om temperature to form the number of cells needed in the although this is not the best tal for the purpose. For quantity tion, cells could be molded in fic by the process now in wide use taking resistors and capacitors: imponents would be spotwelded to other and to the terminal tabs molding.

Resolution Micromanometer

righly sensitive micromanometer, ed to measure differential pressures low as 0.03 micron of mercury 103 mm. Hg or 1.6 x 10⁻⁵ inches of with resolutions of the order of micron Hg, has recently been detected by T. A. Perls, W. H. Kaechele, S. Goalwin. This development tresult of a research program control by the Bureau's Office of Basic mentation and sponsored jointly office of Naval Research, the Air rch and Development Command,

and the Atomic Energy Commission. The NBS micromanometer utilizes a thin diaphragm combined with a capacitance-type pickup and a resonant-bridge carrier system to detect pressure differentials 100 to 1000 times smaller than those previously detectable. Besides measuring static differentials, it can sense pressures that vary at rates up to 20 cps with an accuracy of better than 2%. See Fig. 2.

This device consists of a 3"-diameter corrugated diaphragm made of brass sheet 0.001" thick and mounted in a shallow cylindrical cavity. The diaphragm is placed so as to divide the cavity into two pressure-tight chambers. An insulated electrode passes through the top of the cylinder to become one side of a variable capacitor while the flexible diaphragm forms the other side of the capacitor, which then has a nominal capacitance of about 20 μμfd. Changes in either temperature or pressure within one of the cavities cause the diaphragm to flex and move. This motion varies the electrodediaphragm spacing and, consequently, the capacitance of the system is changed by a small amount. Over the mechanical operating range used, the displacement of the diaphragm varies directly as the pressure differential, and the changes in capacitance also vary linearly with the displacement of the diaphragm. The electronic portion of the micromanometer has sufficient range of sensitivity to respond, with an accuracy of 2%, to full-scale changes between 0.005 and 0.2 $\mu\mu$ fd. above and below the 20-µµfd. capacitance of the system.

The electrode-diaphragm-cavity section of the micromanometer forms the fourth arm of a resonant capacitance bridge composed of three other capacitors, each of which has a low multimegohm resistance in parallel with it. Parallel resistances tend to make negli-

gible any changes in leakage resistance of the capacitors. Driving power for the resonant capacitance bridge is derived from a 500-kc. crystal oscillator; frequency response flat within \pm 1.5% from 0 to 50 kc. is one of the useful characteristics of the carrier circuit. A small difference in pressure between the two cavities in the micromanometer, which causes a deflection of the diaphragm and thus a change in the capacitance of the system, upsets the balance of the resonant capacitance bridge. The 500-kc. output from the bridge varies in amplitude according to the magnitude of the pressure change and in phase (0 or 180°) depending on the direction of the deflection. The signal-modulated carrier from bridge is amplified and then mixed with the unmodulated carrier from the 500kc. driving oscillator in a special mixer, phase discriminator, and dual demodulator stage. In this stage, the two signals add or subtract according to the direction of the original diaphragm disnlacement.

The output of the mixer is a replica of the capacitance change in the resonant capacitance bridge, and, consequently, a measure of the differential pressure. The unwanted 500-kc. and 1000-kc. harmonics in the output are filtered, and the resulting low frequency or d. c. potential is applied through a d. c. amplifier directly to the plates of a cathode-ray oscilloscope or to any other suitable indicating or recording device. Response of the system-both mechanical and electrical - over the pressure range used is sufficiently linear to require the calibration of pressure differential vs. voltage output only at "zero" and at one other point within the operating range, usually chosen near "full scale." Resulting readings can be made with an accuracy of 2%.

(Continued on page 26)

Fig. 2. Cut-away drawing of pressure probe for the NBS thin-diaphragm capacitance-type micromanometer.

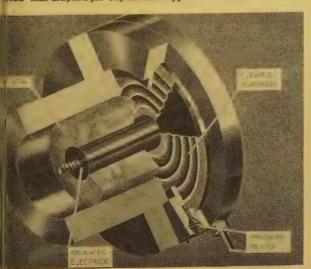


Fig. 3. Inserting an experimental subminiature tube into the recently developed wide-range tube vibrator.



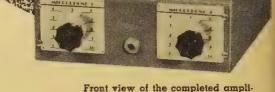
PORTABLE REMOTE BROADCAST AMPLIFIER

By

RAY GILLIAM, Chief Engineer, WKDK

Newberry Broadcasting Co., Inc.

Versatile self-powered amplifier with line-level output is useful for remote sports broadcasts.



REMOTE broadcasting of sports events always presents a problem in high school and small college stadiums. In most cases, the telephone company will provide lines as specified by the engineer. That leaves the radio man at times with the difficult problem of connecting the amplifier to the a.c. line. Climbing poles and running a.c. extension lines a hundred feet or more, only to have someone turn off the receptacle or kick out the plug, are some of the complications involved.

A typical broadcasting station today has a small staff with each man performing two or more functions. Consequently, in many cases, the play-by-play announcer must be his own engineer.

The amplifier to be described in this article has been termed the "Sports Special." It has prevented some gray hairs and simplified many remote broadcasts at Station WKDK. This unit weighs only 12 lb., including batteries,

and is self-contained. It uses four low-drain 1.5-volt "peanut" tubes and small batteries to be described later. Two channels are employed with an extension jack to accommodate the WE 633A microphone, as pictured. The unit is enclosed in a steel cabinet with a sloping front panel, 8" x 8" x 8" in size, which is available as a standard item.

Simplicity is featured throughout the circuit. Two specific characteristics were found to be very desirable. Switch S_1 is ganged to mixer R_2 and breaks the filament supply to that circuit when R_2 is turned off; this in turn conserves battery drain when only one channel is needed. The other characteristic is a relaxation type blinker which indicates the condition of the "B" battery and also serves as an "off and on" indicator. It will be noted that the series resistor to the blinker circuit has a value of 8.2 megohms; therefore, battery consumption is very low.

The circuit shows one high importance input. Inasmuch as most broad cast microphones are low impedance vices, the only change necessary to the second channel would be to additional transformer. At this station, the second channel is used for crowd noise or and utilizes a high impedance microphone, thus saving the cost of another input transformer.

fier with plugged-in microphone.

To be dependable, remote broadel equipment must be rugged. In a structing a unit of this kind, all component parts should be mounted rigic. In the "Sports Special," it is recommended that all tubes have some for of shock mounting. Most battery tustend to be somewhat microphonic who used in high gain circuits, include the output tube.

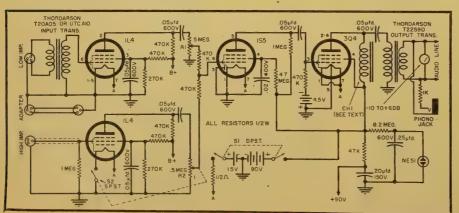
The "A" batteries are held in plo by a spring clip with an insulated c tact on the positive end. Two regy, flashlight cells are connected in past lel to furnish the "A" supply of f volts. A ½-ohm resistor is inserted series with the "A" voltage supply. T conserves the battery and prolongs s life of the tubes.

The "B" supply consists of two sees 45-volt batteries connected in series 45-volt battery r be used in some cases, depending on a gain needed. The "B" batteries are in place in a small compartment.

A bias battery is employed in the eput stage (3Q4). This consists of the Penlite cells connected in series 34.5 volts. These cells are clamped to underchassis and should be replaced once each year.

(Continued on page 30)

Schematic diagram and parts values for the amplifier.



CUT MANUFACTURING COSTS

With high quality Sylvania
Tungsten and Chemical Products



Beneral view of Sylvania tungsten wire drawing department at our Towanda, Pa. plant.

You take no chances—save time and money—when you use Sylvania tungsten and chemical products. Sylvania tungsten is quality controlled from ore to finished product, tested in the laboratory, in the field. Suppliers to all leading manufacturers in the radio and television industry, Sylvania offers you tungsten and chemical products that meet the highest standards of purity, precision, and uniformity.

To help you work out any special high quality product or solve your toughest manufacturing problems, Sylvania maintains large metallurgical and chemical laboratories. If it's a question of anything from a precision, custom-made tungsten component, a special high-purity phosphor, chemical or compound, to silicon or germanium for crystals, put it up to Sylvania. A note on your letterhead brings you full particulars. Address: Sylvania Electric Products Inc., Dept. 3T-3510, 1740 Broadway, New York 19, N. Y.

SYLVANIA

LIGHTING · RADIO · ELECTRONICS · TELEVISION

Canada: Sylvania Electric (Canada) Ltd., University Tower Building, St. Catherine St., Montreal, P. Q.

Tungsten

Radio Heater and Grid Wire Support Wire and Rod Gold Plated Wire Ground Seal Rod Formed or Ground Parts Cut and Bevelled Pieces Hand Wound Coils

Special High Purity Chemicals and Compounds

Potassium Silicate • Etching Inks Carbonate Emission Coatings Mica Spray Coatings Basing Cements

Metal Powders

Silicon • Germanium

Phosphors

Cathode Ray Tube Phosphors



DIELECTRIC TESTER

This dielectric tester, the only one of its kind in the country, was designed and developed by Anaconda Wire & Cable Company engineers. It handles



test voltages up to 15,000 volts at the company's Anderson, Indiana, mill during quality control tests on magnet wire which is used in coil windings. Despite the high voltages handled, safety is built into the device; the opening of any one of its several doors will immediately discharge all current.

RADIO SYSTEMS LABORATORY

The Engineering Division of Stanford Research Institute, Stanford, Calif., has revised the organization of its Aircraft Radiation Systems Laboratory. Expansion of industrial services in aircraft and communications programs has necessitated the regrouping of related technical sections under a new arrangement to be known as the Radio Systems Laboratory. Heading the new structure will be Dr. J. V. N. Granger, assistant chairman of the Engineering Department.

The broadened scope of research and development in radio communications at the Institute has also made it desirable to change the name of the Single Sideband Communications Group to the Communications Group. Formerly a separate research section, the Communications Group will henceforth be a part of the Radio Systems Laboratory.

ACCELEROMETER SYMPOSIUM

More than 250 scientists and engineers attended a Symposium on Barium Titanate Accelerometers held in Washington, D.C., on May 14 and 15, under the sponsorship of the Office of Basic Instrumentation of the National Bureau

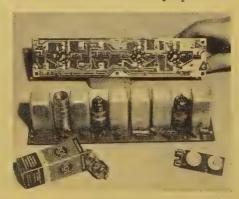
of Standards. Sixty-seven industrial and university laboratories were represented as well as 44 U.S. Government agencies and four foreign government agencies; 27 papers were presented and a number of discussion periods were also included.

The advantages of barium titanate accelerometers for the measurement of high frequency vibrations and the relatively low cost at which they can be constructed have caused many organizations to undertake the development of such instruments for particular applications. This Symposium was held so that the various groups could come together for informal discussion of problems of mutual interest, learn more about available data and proposed theories, and resolve or point out inconsistencies between the results obtained by different investigators.

"PACKAGED" I.F. AMPLIFIER

The television industry's first ready-to-use prealigned i.f. amplifier, complete with electron tubes and printed circuit components, has been announced by the Tube Department of the RCA Victor Division, Radio Corporation of America, Camden, N. J. It is being offered to manufacturers through the Tube Department's Equipment Sales Section, as a finished package, ready for attachment to the chassis.

Called the "Tandem Amplifier," this unit became commercially practical



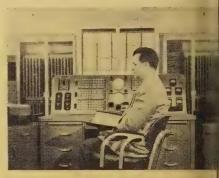
with the successful application of RCA's special photo-etch "printing" process for the production of wiring patterns (top) as well as the coils of the individual components (right foreground). It is a three-stage, 40-mc. i.f. assembly designed for TV sets which

utilize intercarrier-sound systems having picture-i.f. and sound-i.f. carrier of 45.75 mc. and 41.25 mc. respectively

NUMERICAL ANALYSIS INSTITUTE

Since its establishment in 1948, th NBS Institute for Numerical Analysi (INA) has not only pursued intensive theoretical studies in those phases of applied mathematics that have been hampered by lack of suitable numerical techniques but has also conducted research in fields related to the design and construction of large scale computers. In the course of this words SWAC (NBS Western Automatic Computer, shown in photograph) has been successfully completed under the sponsorship of the Wright Air Development Center and put into useful operation.

INA provides a computing service for other Government agencies and especial



ly for their contractors in the Souther California area, solving many problem of aircraft design which originate them It also maintains a consulting servition special problems in applied mathematics and conducts training programs on the theory and application of high speed automatic computing.

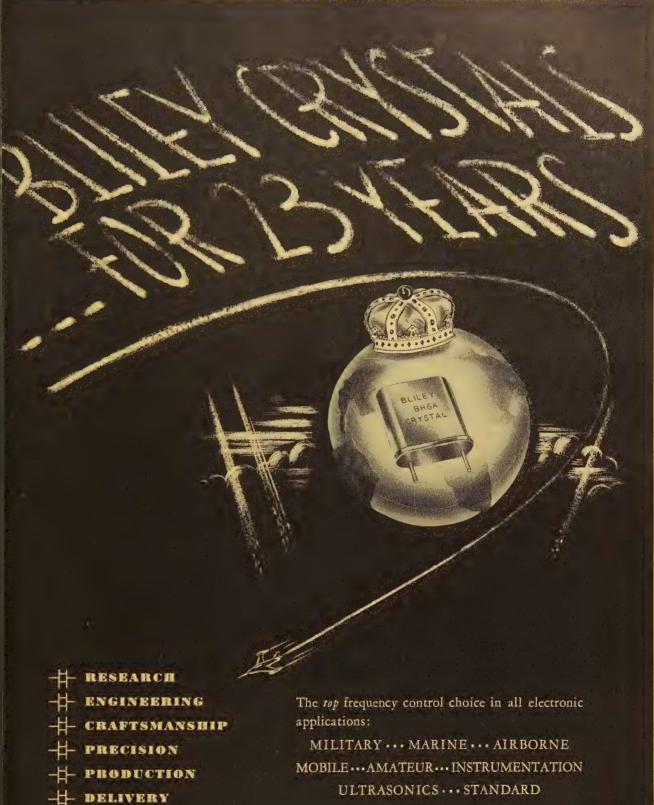
NONHYGROSCOPIC FLUX

According to the Eutectic Weldis Corporation, Flushing, N. Y., the green majority of corrosion problems not mally found in aluminum joining dues the corrosive properties of the slags conventional fluxes can now be minimized or entirely eliminated with a new Eutector Flux 190NC.

Due to the fact that this flux is not hygroscopic, it completely eliminal corrosion caused by the absorption water from the atmosphere who usually occurs when conventional flux are used. While in some instances anature of the slag residue may rese in a small degree of corrosive activities corrosion is but a tiny fractions what has heretofore been known.

PRODUCING TRANSISTORS

Transistors are now being majestured on a production line basis (Continued on page 30)



H- QUALITY

BLILEY ELECTRIC COMPANY

UNION STATION BUILDING . ERIE, PA.

NEW TUBES

MEDIUM-MU TWIN TRIODE

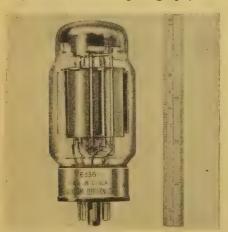
Designed specifically for use as a Class A amplifier and control tube in applications where dependable equipment performance hinges on the ability of electron tubes to take abnormal shock and vibration, the RCA-6101 is a top-drawer version of the RCA-656. A medium-mu twin triode, it was developed by the Tube Department of RCA Victor Division, Camden, N. J., to meet the need for a tube which would couple 656-type characteristics with the ability to withstand the rugged operating conditions of airborne and mobile applications.

Added structural features include: chrome-copper siderods to cool the grids and restrict the development of grid emission; a pure-tungsten heater to provide long life under frequent on-off switching operation; and additional mica insulators to hold parts firmly.

CHATHAM TUBES

Production of two new tubes has been announced by Chatham Electronics Corporation—a high perveance, high plate dissipation twin power triode for voltage regulation, and a miniature hydrogen thyratron for pulse generating applications. Complete data on both tubes is available from Chatham Electronics Corporation, 630 Mt. Pleasant Avenue, Livingston, N. J.

When used as a series tube, triode Type 6336 (shown in photograph) will



pass a minimum of 150 ma. per section at 40 volts d.c. E_p ; with a grid bias of -60 volts, it will pass 150 ma. at 200 volts d.c. E_p . Type 6336 features a hard glass envelope and an eight-pin butt stem.

The new miniature tube, Type VC-1258, is capable of handling peak power up to 10 kw. Designed to fit a standard ceramic miniature socket, it is rated at 1000 peak anode volts, 20 amperes peak anode current, and 40 ma. average anode current. Repetition rates in excess of 10,000 pps are possible at reduced ratings.

"B" PLUS BOOSTER

Workman TV, Inc., Teaneck, N. J., has introduced its new Model 5TV4 "B" plus booster, intended to replace the 5T4G in television receivers to provide greater height, width and gain. It is available for immediate delivery.

A built-in time delay (patent pending) acts as a choke input for the



Model 5TV4. Other advantages include additional filtering and infrequent replacement.

TETRODE AND PENTODE TRANSISTORS

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y., has announced that its development work on tetrode and pentode transistors has progressed to a point at which commercial production is feasible; this company plans to have both units available before the end of the year. In the circuits of a number of potential applications, one tetrode is expected to do the work of two triode transistors, and in some cases, one pentode may do the work of three triodes.

Because these new transistor types have more elements than the triode transistor and will serve as replacements for triodes on a one-for-two or one-for-three basis, they should result in greatly simplified circuitry and permit the building of still more compact

electronic equipment. Sylvania's bas research work on semiconductor devic is being carried on at its research la oratories at Bayside, N. Y.

IGNITRON

The addition of a new Class B ign tron to the *National* line of industrictubes has been announced by *Nation*



Electronics, Inc., Geneva, Ill. Desenated as NL-5551, this ignitron is metal, water-cooled, mercury-pool trofor welder control and similar a.c. of trol applications. Its rating is appropriately equivalent to a 300-amplification of the contactor.

NL-5551 has a stainless steel, sees welded construction. The mercury-recathode permits the tube to handle a tremely high currents on an intermetent basis.

DECADE COUNTING TUBES

Combining extreme reliability we comparatively high speed and lack moving mechanical parts, the GCD and GC10B are said to represent advance in the direction of simplificounting circuitry. They are both cocathode, bi-directional, glow transcounting tubes which have been added to the series being distributed in Atomic Instrument Company for Expression Telephones, Ltd.

GC10M is a miniature tube design for use in medium-speed decimal cooling apparatus such as scalers, counters and dividers. Maximum infrequency is 600 pps, and output vage developed across cathode resisted 15 volts. GC10B operates at a momum input frequency of 4000 pps; count is determined by noting the radially spaced cathodes around caxially positioned anode.

Further information on these decounting tubes may be obtained f Dept. GC-1, Atomic Instrument C pany, 84 Massachusetts Avenue, C bridge, Mass.

What means most to an Engineer?



PROFESSIONAL RECOGNITION



GOOD SALARY



UNEXCELLED FACILITIES



SUBURBAN LIVING

A Career at RCA offers all Four!

A offers opportunities now—real per opportunities—for qualified extronic, Computer, Electrical, a chanical and Communications gineers...Physicists...Metalegists...Physical Chemists...

Change of the communities of the communication of the c

oitions are open in research, developnt, design and application. Long ge work in many fields is being carted on both for commercial developnts and military projects for war d peace.

RCA you'll work in an exciting prosional atmosphere, with technical laboratory facilities unsurpassed where in the radio-electronic industry are in close and constant

association with leading scientists and engineers. Individual accomplishment is not only recognized, it is sought out. Delightful suburban living is easily available for your family. And there's ample opportunity for income and position advancement.

Plus, Company-paid hospitalization for you and your family . . . accident and life insurance . . . progressive retirement plan . . . fine recreational program . . . modern tuition-refund plan at recognized universities for advanced study.

Join the team at RCA, world leader in electronic development, first in radio, first in recorded music, first in television. Rest easy in the knowledge that your future is secure, the rewards many and varied.

Personal interviews arranged in your city.

Please send a complete resume of your education and experience to:

MR. ROBERT E. McQUISTON, Manager

Specialized Employment Division, Dept. 204-J Radio Corporation of America 30 Rockefeller Plaza, New York 20, N.Y.

Positions Open In: RESEARCH— DEVELOPMENT—DESIGN—APPLICATION in any of the following fields:

RADAR—Circuitry—Antenna Design—Servo Systems—Information Display Systems—Gear Trains—Stable Elements—Intricate Mechanisms

COMPUTERS — Digital and Analog — Systems Planning — Storage Technique — Circuitry — Servo Mechanisms — Assembly Design—High Speed Intricate Mechanisms

COMMUNICATIONS — Microwave — Aviation — Mobile—Specialized Military Systems

MISSILE GUIDANCE—Systems Planning and Design
—Radar and Fire Control—Servo Mechanisms
—Vibration and Shock Problems

NAVIGATIONAL AIDS — Loran — Shoran — Altimeters — Airborne Radar

TELEVISION DEVELOPMENT—Receivers—Transmitters and Studio Equipment

COMPONENT PARTS—Transformer—Coil—Relay
—Capacitor—Switch—Motor—Resistor

ELECTRONIC TUBE DEVELOPMENT—Receiving— Transmitting—Cathode-Ray—Phototubes and Magnetrons

ELECTRONIC EQUIPMENT FIELD ENGINEERS —
Specialists for domestic and overseas assignment on military electronic communications and detection gear.



RADIO CORPORATION of AMERICA

NEW PRODUCTS

VARIABLE IMPEDANCE WATTMETER

Fast, accurate power measurements between 2 and 30 mc. are possible with the variable impedance wattmeter which has been announced by Sierra

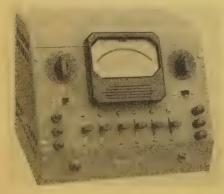


Electronic Corporation, 1049 Brittan Avenue, San Carlos 2, Calif. Designating its input impedance as Z=R+jX, R can be adjusted over a broad range of 5 to 500 ohms and jX can be adjusted between \pm 250 ohms. Up to 250 watts of power may be dissipated, and over-all accuracy of the power measurement is within 10%. Accuracy of impedance magnitude is within 5%.

The Model 141 is simple to operate. Correct impedance is established for each frequency by setting three counter type dials in accordance with an easily read calibration book. Power is read directly on a large front panel meter.

TRANSISTOR TESTER

Here is an instrument which affords a means of testing transistors, diodes, and other semiconductor devices on a direct-reading "go no-go" basis. The Model TT-11 transistor tester, being marketed by *Electronic Research Asso-*



ciates, Inc., Box 29, Caldwell, N. J., utilizes a bridge method for comparing the characteristics of the unknown with

a known reference transistor. Variation from standard for a given test is read directly on a calibrated "good-bad" meter scale.

Both static and dynamic tests are performed, and results are independent of voltage and temperature variations. Static tests are made on forward diode (emitter-base) characteristics and reverse diode (collector-base) characteristics. Dynamic testing includes both amplifying and oscillation condition comparison with the reference transistor.

ALLOY PASTE SOLDERS

Use of the HR electrical series of paste solder alloys recently announced by *Fusion Engineering* eliminates the separate fluxing operations encountered



with preforms, foil or wire. Due to the fact that the flux is incorporated in the alloy with the solder, the paste may be preapplied semiautomatically or automatically by unskilled help and heated with automatic equipment.

Designed for electronic connections, the HR series is suitable for transistor and diode soldering and printed circuits as well as for general electronic applications. An activated high-rosin flux is used to prevent corrosion. Further information concerning these paste alloys, available temperature ranges, and application methods may be obtained by writing to Fusion Engineering, 4504 Superior Avenue, Cleveland 3, Ohio.

PULSE GENERATOR

Wide ranges of pulse duration, amplitude, recurrence rate and positioning are provided with the Model PG-200A pulse generator—a medium-power precision instrument for generating adjustable rectangular waveforms having

fast rise and decay times. It may operated as a self-synchronous unit driven by an external signal of almost any waveform.

Pulse width and pulse position wherespect to the sync output trigger a continuously variable from .05 to pusec. by means of calibrated control Rise and decay times of pulse constant



are equal to .03 µsec. or less from 1 to 1000 µsec. pulse width. Pulse repetion rate is from 1 to 20,000 pulses µsecond.

All inquiries on the Model PG-202 should be addressed to Department F Teletronics Laboratory, Inc., 54 Kini Street, Westbury, L. I., N. Y.

MOBILE TWO-WAY RADIO SETS

Additions to the *Motorola* line of 54 mc. FM two-way radio equipment a clude the T41G series, having a nor inal r.f. power output of 30 watts (photograph), and the T51G series, hing a nominal 60-watt r.f. output. Th' mobile models feature such innovation as universal 6-12 v.d.c. operation, d interrupter vibrator power supply, a drastically reduced power drain.

Use of a newly developed all-vibrar power supply results in an overa drain reduction of almost 50%; who operating from a 6-volt battery, the watt model requires 10.5 amperes.



standby and only 43 amperes duritransmit periods. Power drain of 30-watt unit is approximately equal that of a conventional 10-watt transmiter-receiver combination. For furtinformation, contact Motorola I Communications & Electronics Divisi Technical Information Center, 4545 Augusta Blvd., Chicago 51, Ill.

MINIATURE SHIELDS

The Staver Company, Inc., man facturer of electronic specialties,

funced a new series of "Miniilds" designed for shielding miniatubes in printed circuits. Like the rlard "Mini-Shields," the 400 es minimizes vibration and provides for operation.

te principal design change in the Series is a flared bottom which is each shield to pass over the ind lug of the printed socket easily. I holds the shield firmly in place and ires contact between shield and ind. For complete details and specitions, write to The Staver Company, 41-51 North Saxon Avenue, Bay 1 e, L. I., N. Y.

JARE WAVE GENERATOR

psigned to fill the need for a preon square wave generator convenito use, yet moderately priced, the SKL Model 504 produces square evoltages without tilt or overshoot. The second square converses the square converses the square converses the square converses the square converses to the squ



cimicroseconds) makes the unit ideal etesting the response of audio, i.f., and video amplifiers. Calibrated cage is continuously variable from 111 volts.

he Model 504 has a frequency ich with nine positions: the first permits operation at any frequency termined by an external capacitor, le the remaining seven positions wride frequencies from 0.5 cps to 0000 cps in decade steps. For further termation, write to Spencer-Kennedy soratories, Inc., 186 Massachusetts onue, Cambridge 39, Mass.

PIABLE REJECTION FILTER

clodel 360-A, an adjustable rejection or recently announced by the Krohnis Instrument Company, provides er a rejection band in which the falls at a rate of 24 db per octave a sharp single frequency null. A king factor is used to reduce the equation at the cutoff frequencies. It is both the high and low cutoff freencies are independently adjustable in 20 cps to 200 kc., the rejection individth is continuously variable up

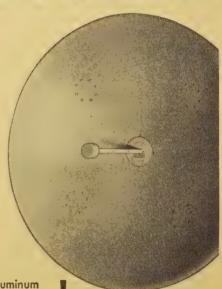
(Continued on page 31)



TRANSMISSION COSTS

with WORKSHOP Microwave Antennas

Recent installations of Workshop Microwave Antennas have replaced hundreds of telephone lines and several coaxial cables. Railroads, oil companies, and broadcast stations report remarkable savings in installation, operation, and maintenance costs.



REFLECTORS—Precision-formed aluminum and laminated fiberglas reflectors.

MOUNTINGS—Popular 3- or 4-point mounts can be supplied with all antennas.

R. F. COMPONENTS—Precision machined and heavily silver plated, expertly designed by the Gabriel Laboratories.

ELECTRICAL DATA—A series of elaborate measurements of both pattern and impedance are made on production units to assure adherence to specifications. VSWR measurements across the band are furnished with each antenna.

POLARIZATION—Either vertical or horizontal polarization can be obtained by a simple adjustment at the rear of the reflector.

MODELS—Workshop can supply microwave antennas covering the 940, 2000 and 7000 magazyele hands. A wide range

and 7000 megacycle bands. A wide range of antenna sizes and feed types are available. For further information write, or phone Norwood 7-3300.

WORKSHOP ASSOCIATES DIVISION THE GABRIEL COMPANY

ENDICOTT STREET NORWOOD, MASS.

Other WORKSHOP Products

UHF Transmitting Antennas—For UHF television broadcasting—new cosecant antenna.

Beacon Antennas—For fire, police, taxicab, and private fleet communications.

Parabolic Reflectors— Over 50 different reflector sizes and focal lengths.





By WILFRID B. WHALLEY

Adjunct Professor of Electrical Engineering Brooklyn Polytechnic Institute

Single-gun tricolor tubes for color television.

SEVERAL designs of three-gun tricolor picture tubes were discussed
last month. All presented various
problems, the most serious being the
difficulty of maintaining registration of
the three electron beams over the whole
picture area. Therefore, many engineers have tried to develop suitable
single-gun tricolor picture tubes, not
only for the sake of simplicity and
lower cost, but to minimize or eliminate the problem of maintaining registration.

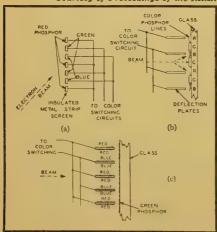
Single-gun tubes cannot give light output simultaneously in all three primary colors. However, it is gradually being realized that color signals which are generated and received by subcarrier modulation (in one form or another of "simultaneous color") can readily be modified in the receiver to give color signals in sequential form at a suitable switching rate. Hence, all presently known color television systems can make use of correctly designed single-gun tricolor tubes.

Methods of Color Control

Many ingenious methods of color control have been proposed. These have included: changing the color of the emitted light by changing the velocity of the

Fig. 1. Beam control at phosphor screen for changing color. (A) Simple line-screen color switching. (B) Deflection switching of colors with line screen. (C) Deflection switching without need for registry.

Courtesy of Proceedings of the I.R.E.



electron beam; making the color screen from a sandwich of alternate phosphors and insulated mesh grids; and modifying the aperture "mask" type of tube to use one electron gun. Each of these three proposals presents fundamental problems and has its limitations.

Electron velocity changes produced by changes in the second anode voltage require compensating changes in the horizontal and vertical scanning fields to maintain the same picture size. Changing the scanning amplitudes without some undesired change in waveform is difficult. Also, as large voltage changes are needed to obtain appreciable color differences, high power at high voltages would be required.

A tube with a color screen of alternate phosphors and wire grids has a narrow viewing angle. This is due to the elements of the picture of one color being displaced in depth (sandwich thickness) from the elements of another color.

In the single-gun type of aperture "mask" tube, the screen depends for color control upon the angle of arrival of the electron beam. The correct angle is obtained by rotating the electron beam about the axis of the tube with an auxiliary two-phase sinusoidal deflection field positioned ahead of the scanning yoke. With such a tube, a basic problem exists in that the electrons must be made to pass through the same aperture at all points of the screen for each angular position of the rotating field. Since the mask collects more than 80 per cent of the electrons, the light output is also quite low.

Insulated Sectional Screen

Another suggestion was to fabricate the phosphor screen out of a woven mesh of three insulated phosphor-coated conductors, and bring the leads out to three terminals as indicated in Fig. 1A. If one conductor were placed at normal second anode voltage while the other two were at zero or slightly negative potentials, then the electrons in the scanning beam would be collected only by the first conductor. Since each conductor in the mesh would be successively at the same second anode voltage, no

change in scanning amplitudes would be necessary, and there would be a problem of registration. However, it quite difficult to insulate a finely wovemesh for voltages of 15 to 18 kv., as to switch such large voltages would require expensive circuits.

Screen Deflection Control

In the woven screen proposal, to point of arrival of the electron bear can be determined only by switching high voltages. If the electrons could influenced by a suitable field overslonger path, the control voltage would be smaller.

This suggests a better method of controlling color in which a structure, consisting of a large number of parallel conducting strips, is placed near the phosphor screen and interconnected that all of the odd-numbered strips a brought out to one auxiliary terminical while the even-numbered strips are to a second terminal. If the average petential of the assembly is the same of that of the phosphor screen, and the even strips are made positive with a spect to the odd strips, then an electrobeam passing to the tube face will bent in one direction.

As sketched in Fig. 1C, some expendental tubes with this type of color of flection control had two of the color phosphors on opposite faces of a strips, while the third color phosphor was in the usual position at the face the tube. With typical second anode cerating voltages, a voltage different between the deflection plates of only few hundred volts is sufficient for cost switching. When the voltage different is zero, the electrons excite the phyphor which is on the face of the tube.

Such a tube can give positive control of color, and is relatively simple to construct. However, there is loss of light from those phosphors which are local on the metal strips, due to passes through the third phosphor coating the screen. Even with a thinly setting reen phosphor, superimposed on necessary thin conducting film, the light loss is appreciable.

Fig. 2. Sketch showing focusing action of an electrostatic cylindrical lense

Courtesy of Proceedings of the I.II

RED

BLUE

RED

BLUE

RED

GREEN

BLUE

way of avoiding this loss of light be to place the color phosphors in ate strips on the face of the tube, own in Fig. 1B, and align the de-In structure so that there would be sections of phosphor between each of deflection plates. Tubes of this whave been constructed, but are d in resolution (in the direction deflecting field) since each color must be wider than the diameter delectron beam.

ence Tube

E. O. Lawrence proposed a valuhodification of deflection color con-In his design, the control structure imposed of a large number of thin mounted under tension on an nted rectangular metal frame. creen is made up of a correspondnumber of phosphor strips, as in Fig. 2. Further, the wire ture is placed a short distance from the phosphor surface and is Ited at an average voltage much than the phosphor. Typical volt-Jare 4.5 kv. for the control strucand 18 kv. for the phosphor.

sume that the wires in the grid rure are all at the same 4.5-kv. tial. The electron beam, in passwill not receive any added deflectbut will continue on toward one of the green phosphor strips. After entering the region beyond the wire structure, the electrons will be accelerated and also focused by the lens system formed between the parallel wires and the much higher voltage phosphor screen. This focusing action reduces the beam dimension in a direction perpendicular to the phosphor strips.

The fact that the electron beam at arrival is reduced in size makes possible a tube having a large number of alternate red, green and blue strips, and having a resolution in all colors comparable to the number of writing lines used in normal television scanning. A further advantage is that the wire structure has somewhat lower capacity than a strip type of structure, and at the same time controls electrons traveling at only one-quarter of the usual monochrome tube velocity (4.5 kv., as compared to 18 kv.). A peak-to-peak voltage of about 500 is sufficient to shift from green to red, or-with the opposite polarity-from green to blue.

It will also be realized that the power required for horizontal and vertical scanning of this type of tube is much less than that required for standard monochrome picture tubes.

Since the control structure capacity is moderate, and the maximum required voltage difference is only 500, color switching is possible at frequencies up in the megacycle range. At such frequencies, the capacity of the structure is resonated with a suitable inductance. and the tube can be controlled by sinusoidal waveforms in combination with correct modulation voltages on the cathode or grid of the electron gun. At low switching speeds, such as for field sequential color systems, the power required for color control is negligible. In fact, three miniature receiving type tubes are adequate for generating the waveforms and driving the wire struc-

Due to the use of thin wires, the electron-light output efficiency is very high, being approximately 90%. Hence, this type of single-gun tube gives bright pictures with beam currents the same or less than required by monochrome tubes. By constructing the phosphor screen so that the spacings between the phosphor lines increase slowly toward the edges of the picture, this type of tube can be made as short as a typical black-and-white tube for the same area of picture. With the wire structure correctly aligned, and this is necessary only in the dimension parallel to the phosphor strips, there is no problem of registration of the color images as in other types of color tubes-especially those having three guns.

SKL WIDE-BAND DISTRIBUTION SYSTEM FOR TELEVISION





iews of SKL Model et, mounted one polpole (bottom).

Vermont Tele-

The -SKL- Distribution System provides simultaneous distribution of up to thirteen television channels, FM signals, and, if required, broadcast signals. Although the -SKL- system is inexpensive in initial cost, no effort has been spared to provide high quality, long lasting, low obsolescence designs and equipment. An unusual feature of the -SKL- system is the Model 212TV Chain Amplifier. These broadband amplifiers continue to operate even though a tube fails, which insures the high reliability so necessary in such a system. The -SKL- system is designed to have the lowest maintenance cost of any system on the market today, not only because of the reliability of the amplifiers which require no tuning or adjustment, but also because vacuum tubes have been eliminated in all other parts of the system. Only the -SKL- system can offer the long life, low obsolescence and low maintenance costs that are required for the long, profitable operation of distribution systems.

Write today for further information.

Right: Photo of erection of one of the two Horn Antennas at Barre, Vermont, for Vermont Television, Inc. These antennas, having 20 db gain, provide good signals from WBZ-TV Boston, 140 air miles, and WRGB Schenectady, 130 air miles.

The Finest in Precision Equipment

Personals



IRVING J. ABEND will head the newly formed Applications Engineering Department of the General Ceramics and Steatite Corporation, Keasbey, N. J. Mr. Abend has had 17 years of experience in the development and production of electronic, communications, radar and nucleonic equipment. Formerly chief engineer of the Freed Radio Corporation, he has also been associated with Air Associates, International Detrola Corporation, and the David Bogen Company.



WILLIAM C. COTHRON, TV station engineering specialist, has been employed by the consultant firm of Unitel, Inc., 205 East 42nd Street, New York, N. Y. Mr. Cothron's duties will take him to Tokyo, Japan, where he will supervise the installation of the first of the chain of TV relay stations being sponsored by the Nippon Television Network Corporation. Prior to joining Unitel, Inc., he was with Allen B. Du Mont Laboratories and Radio Corporation of America.



OSCAR F. HAUG is the project engineer for the "Ultra-Viscoson," ultrasonic instrument for measuring viscosities of fluids. Formerly a design and development engineer of guided missile electronic components at the Research Laboratories of Bendix Aviation Corporation in Detroit, Mr. Haug now moves to the company's Cincinnati Division to handle engineering for volume production of this new instrument. He served in the Air Force during World War II.



LEON PODOLSKY has been appointed chairman of a new committee organized by the American Standards Association in the field of electronic components—Sectional Committee C83—in the Communications Division of the ASA Electrical Standards Board. Mr. Podolsky, who is technical assistant to the president of Sprague Electric Company, is also chairman of RETMA's International Standards Committee and a member of various other engineering societies.



KENNETH M. UGLOW has opened an engineering office at 1507 M Street, N. W., Washington, D. C., to provide planning, design, and analysis on radio communication, telemetering, and radar systems, as well as consulting service for development engineering groups. From 1943 to 1946, Mr. Uglow was engaged in microwave radar development for the General Electric Company; since then he has been an electronics consultant at the Naval Research Laboratory.



HERMAN L. WECKLER, who was vice-president, general manager, and a director of Chrysler Corporation for 13 years until his retirement in April, has now been elected vice president-operations of the Clevite Corporation. In his new post, he will have general responsibility for the operations of Clevite Corporation's manufacturing and selling units, including Cleveland Graphite Bronze Company, Brush Electronics Company, Harris Products Company, etc.

Developments at NBS

(Continued from page 15)

Using a capacitance-type pickup resonant-bridge carrier system, micromanometer depends on the arand thinness of the diaphragm and the sensitivity of the electronic circle for its high resolution. Deflections of order of one millionth of an inch (iscale) and capacitance changes 0.005 µµfd. are involved. In resolutionand sensitivity, the NBS micromand eter shows a decided improvement of other devices also designed to measure static and semistatic differential procures with the aid of diaphragms.

Tube Vibrator

Electronic equipment is being can upon increasingly for applicating where it can be subjected to seve shock and vibration, and engineers h had to develop special componer rugged enough to withstand such sta uous service. Electron tubes present particular problem from the standpd of severe vibration. In addition being strong enough not to fail chanically, an electron tube mustis low in microphonics; spurious eleccal signals generated by vibrations the tube must be low in relation to desired signal that the tube must h dle. In ordinary receiving tubes, min phonics may easily be a thousand even a million times greater than i intrinsic tube noise. In miniatura equipment, tube microphonics can t very difficult problem.

An improved wide-range vibrar generator is facilitating the study low-microphonic tubes in the I Electron Tubes Laboratory. Recen developed by J. D. Rosenberg, W. Hillstrom, and L. T. Fleming, this 's vibrator produces accelerations up 20 times that of gravity and is within 20% over the unusually range of 100 to 10,000 cps. The ; under study is fitted into a hole ini vibrator's moving element-or are ture—which is a cylindrical block nonmagnetic material with a "v" coil" for the a.f. driving voltage a lower end. Two flexible metal st: hold the armature centered in an a tromagnetic field structure powerer 40 watts of 120-volt direct curn Although the only model of the vibrb thus far constructed was built to: commodate subminiature-type to the design could readily be modified microphonic studies of miniature octal tubes. The complete unit is sks in Fig. 3.

In this vibrator, the upper frequilimit is raised over that of commercity available units by making the acture simple and rugged, out of a second control of the control of

having a high ratio of rigidity that Linen bakelite, which is deferately good in this respect, ed for the present armature behigh its convenience and availabilindamental resonance occurs in ighborhood of 18,000 cycles; resolved the use of a material with a rigidity-to-weight ratio would attally raise the frequency of mental resonance, and thus the relimit of flat response.

clopment of the tube vibrator was sent upon the previous developof a small barium titanate accelor capable of measuring vibraequencies to 20 kc. at acceleration of 0.2 to 10,000G. One of these cometers is mounted on the armaof the vibrator to sense the vibrainplitude.

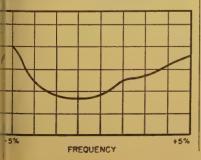
wher barium titanate acceleromimilar in shape and weight to
subminiature tube, was developed
sly to meet needs arising in the
coment of the vibrator. A conint tube holder had to be designed
the vibrator which would be suffifree from stray compliances and
inces to assure that the motion of
be would conform closely to the
of the vibrator up to at least
The subminiature-tube-type acinter facilitated the design of
tube holder.

wowave Antenna

sinued from page 13)

harrive at the matched condition re entire array, a slot length was rid which produced a normalized ance value of 0.25. Four of these ies would then present a normalenpedance of 1.0 + j1.6, the reacomponent of which is easily canby correctly placing the series circuit at the end of the antenna. ver, this short-circuited section of ill develop an incremental reactopposite in sign to that of the rag elements as the frequency is vathus producing desirable broadproperties. Figure 4 is a plot of R vs. frequency for the array. ssurizing was accomplished by

4. Voltage standing-wave ratio frequency for final antenna array.



cementing small polystyrene beads in the line to seal the slots, resulting in a negligible impedance disturbance. The slot widths had previously been designed to handle the required magnetron power, so that no voltage breakdown trouble was experienced.

A photograph of the array is shown as Fig. 1, indicating very closely the essential simplicity of this antenna.

~⊕**~**

Gain Rider

(Continued from page 8)

a 2.5-db increase in compression of the amplifier's output signal. This is the result of lowering the difference in attenuator tube plate voltage during varying degrees of compression.

Eliminating $R_{\rm s}$, the voltage at the attenuator plate will rise from 37 to 112 volts for a compression extreme of 0 to 15 db. Including $R_{\rm s}$ in the circuit, the minimum to maximum voltage is 27 to 65 volts.

Outside of standard low-level wiring practices, there is no need for any special caution in wiring the unit; R_2 and C_2 should be located close to the 6K7 grid terminal board, however.

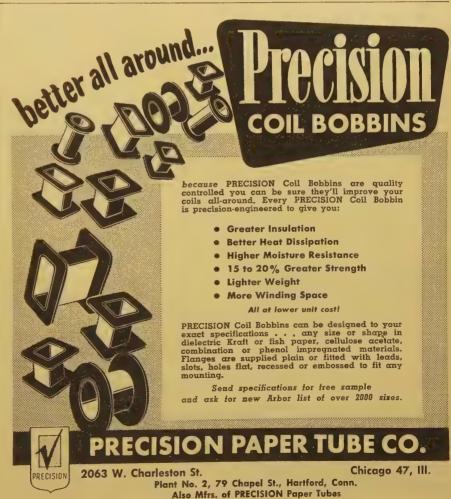
Selection of a quiet tube for the first stage of the amplifier may be

necessary due to noise originating in this stage. On low program passages and silence, this tube will raise the noise level in the amplifier's output by the amount of compression employed.

R₁, a step-type attenuator equipped with detent, was installed to replace the small carbon potentiometer with which the amplifier came equipped, as experience showed that this control could be accidentally kicked open or shut during an unattended broadcast.

Attenuation in the H-pad from the output of the amplifier should be selected according to the level intended to be fed to the line. With 23 volts of positive bias to overcome on the audio rectifier before compression begins, the level across the line winding of the output transformer at this point will rise to approximately +17 db. At this station, a 15-db attenuation pad was chosen which allows the amplifier to feed to the line levels of approximately +2 db at the threshold of compression to +6.75 db with the amplifier under 15 db of compression.

Provided that an instantaneous attack time is not essential, it is believed that this simple method of gain control can be used effectively in almost any audio equipment requiring automatic gain control of the output level. —®—



RADIO REMOTE CONTROL

The practical application of radio remote control for electric industrial trucks and tractors is demonstrated in Bulletin No. 534, a copy of which may be obtained from Barrett-Cravens Co., 4609 South Western Blvd., Chicago 9,

Photographs taken in a large food products warehouse show how a substantial amount of time can be saved in the movement of materials and goods by the remote control system called "Radox." Orders can be filled more rapidly and worker fatigue is greatly reduced.

PLASTIC COMPONENTS

Various types of precision-machined plastic components are described and illustrated in the four-page brochure being offered by the Tri-Point Manufacturing and Developing Co., 401 Grand Street, Brooklyn 11, N. Y. Included are such plastics as Teflon, KelF, Nylon, Formica, Rexolite, Polystyrene, Polyethylene and laminated phenolics. Tolerances of .001" are held on production runs of components made in standard sizes or to specifica-

CABLES

"Federal Quality Controlled Cables" is the title of a 28-page catalog which may be obtained by writing to the Selenium-Intelin Department, Federal Telephone and Radio Corporation, a division of International Telephone and Telegraph Corporation, 100 Kingsland Road, Clifton, N. J.

Among the topics covered in this catalog are the various cable types and components, cable production, TV transmission lines, and community TV lead-ins. Also included are two-way cable selection tables, impedance nomographs and a reel selection guide.

VACUUM IMPREGNATION

A revised edition of a 24-page brochure on "Vacuum Impregnation" has just been released by F. J. Stokes Machine Company. It presents in detail the versatile process by means of which voids in porous materials are filled with a desired impregnant after air and moisture have been evacuated. Applications include: the sealing of metal castings against microporosity, improvement of dielectric efficiency in electrical components, and the potting of transistors.

Copies of Catalog No. 760 may be obtained free on request to F. J. Stokes Machine Company, 5500 Tabor Road, Philadelphia 20, Pa.

WIRE FORMED PARTS

Pix Manufacturing Company, Inc., 22 Bedford Street, Newark, N. J., has announced the availability of a 16-page, two-color catalog on wire formed parts and stampings. Profusely illustrated, it shows delicate wire formings ranging from .002" in diameter to .156" in diameter, and stampings having a thickness of from .005" to .125", with diameters of 1/4" to 3". Many different metals and alloys are used in the production of these parts.

ELECTRONIC INSTRUMENTS

its facilities for the design and progr tion of special electronic and elecmechanical instruments for laborat and industrial use. A number of pi ucts are illustrated and pertinent d are given regarding specifications performance.

Copies of the prospectus and furti information can be had on request Manson Laboratories, 207 Greeny: Avenue, Stamford, Conn.

VIBRATION ISOLATOR

Barry Product Bulletin 532 prese technical and performance data on, new Type 915 "Barrymount"-an a lator of vibration and noise caused motor generator sets, high-speed pressors, grinders, fans, blowers, similar equipment.

Published by The Barry Corporar 870 Pleasant Street, Watertown: Mass., this bulletin discusses then stallation of the Type 915 isolator) gives complete data on load range physical dimensions, isolation efficied at various frequencies, and variatio natural frequency over the range rated loads.

TV TUBE COMPONENTS

Tungsten and chemical component for television picture tubes are scribed in a four-page booklet available on request from the Tungsten Chemical Division, Sylvania Ele-Products Inc., Towanda, Pa.

Among the components covered screen phosphors, potassium sil for screen settling, tungsten wire cathode heaters, and triple carbot cathode coatings. A description stranded tungsten coils and filam for vacuum metalizing (used in ther minizing of picture tube screens also given.

MEASURING EQUIPMENT

GEC-1016A is a revised edition G-E's 64-page measuring equipa catalog. Containing information more than 115 testing and measus devices for laboratory and produl line use, it is now available from General Electric Company, Schenec 5, N. Y.

Products covered in this full; lustrated publication range from si current indicators to completely matic oscillographs; from su roughness scales to mass spectrome and from d.c. amplifiers to radia monitors.

VACUUM FURNACES

In a four-page bulletin issuen the F. J. Stokes Machine Comp a number of processes now being ried out in the building of three



20,000 OHMS PER VOLT SENSITIVITY

20,000 OHMS PER VOLT SENSITIVITY
New Simpson V-O-M is sensitive, measuring as low as 80 microamps, full scale. 33 ranges customized to meet the needs of the electronic and electrical industries. Only 2 controls... saves time... insures accuracy. Big 7" dial features extra long scales. Rugged construction for rugged use. Accuracy 3% DC — 5% AC.

Size: 7-15/16 x 6 x 2-15/16". Complete with test leads, removable alligator clips, 4000 VDC multiplier and operators manual Dealer Net \$68.00

NEW Model 269 AC-DC ULTRA SENSITIVE VOLT-OHM MICRO AMMETER 100,000 OHMS per volt

New ultra-sensitive instrument proves ideal for voltage measurements in high sensitivity circuits, TV receivers, laboratory research, etc. 33 ranges including 0-16 microamps and 0-200 megohms. Seven includial features extra long scales for precise reading. Accuracy is 3% DC and 5% AC.

Size: 7-15/16 x 6 x 2-15/16". Complete with test leads, removable alligator clips, 4000 VDC multiplier and operators manual. Dealer Net \$88.00

Complete Line of Simpson products always in stock for prompt delivery. Order now or write for literature.



Manson Laboratories has just released an eight-page booklet outlining

um furnaces are discussed in destitled "Vacuum Furnaces and pplication to the High-Vacuum ing of Metals," Catalog No. 770 ints out the advantages of vacunaces for commercial use and e types currently available from npany.

opies of Catalog No. 770, write Stokes Machine Company, Vacuuipment Division, 5500 Tabor Philadelphia 20, Pa.

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Transmission

dued from page 12)

ngle-sideband equipment with carrier demodulation; equipf this type has been referred to sly1.

a single-sideband suppressedsignal is being interfered with ther SSSC signal of the same h, within 30 cycles of the same ir" frequency, both signals are ible provided that both are litting the same sideband. The deterodyne, characteristic of two ging AM signals, is absent res of the frequency separation SSSC signals. Without the disor heterodyne, the ear is readily discriminate against the unsignal. The effect is much the is that noted in a crowded room several people are talking at ne time and at about the same s: it is nearly always possible ract the desired conversation. the two signals are of unequal the discrimination properties of r are impaired; however, exde has shown that differences of ch as 10 db still provide fair libility of the weaker signal. If transmissions are on opposite ads, the selectivity of a singleand receiver of the type mentioned jovide 30 db or more rejection of ndesired signal; it is readily e for two stations on the same r" frequency to operate on difsidebands without mutual inter-

rference between two SSSC sign adjacent channels, i.e., within 3 t. of each other, with both transis the same sideband, results in Inal being unintelligible when the ar is properly tuned to the other. these conditions, the discriminaroperties of the ear are substanimproved over the cochannel case, te signals may differ in level by 20 db before the weaker one becunreadable.

conventional AM transmission, plarly at the lower frequencies, ration conditions are frequently nat the carrier fades and in some

cases practically vanishes while the sidebands remain relatively unaffected -resulting in a particularly severe form of audio distortion at the receiver. In SSSC, using exalted-carrier receiving equipment, this effect is not present. Hence, readability can usually be maintained to a considerably lower signal level than is normally possible with double-sideband AM. Certain short time-constant a.v.c. circuits tend to minimize sudden or large changes in audio level which result from fading of the single-sideband signal.

As pointed out earlier, in SSSC reception the receiver bandwidth may be effectively one-half that required for the equivalent double-sideband AM signal without deterioration of the higher frequency sideband components. Noise and atmospheric disturbances may be considered as uniformly spread over a relatively wide band insofar as the actual communication channel is concerned. Halving the receiver bandwidth will effectively halve the noise voltage accepted by the receiver without in any way affecting the received signal. The signal-to-noise ratio is improved by some 6 db, which more than makes up for the small loss incurred through elimination of the sideband at the demodulator.

REFERENCES:

Moses, R. C., "Exalted-Carrier Single-Side-band Reception," RADIO-ELECTRONIC ENGINEERING, March, 1952.
 Dome, R. B., "Wide Band Phase Shift Networks," Electronics, December, 1946.
 Nibe, G. H., "Audio Phase-Shift Networks," QST, January, 1950.

of Coming Events

SEPTEMBER 28-30-National Electronics Conference, Hotel Sherman,

OCTOBER 5-8-Fall Technical Meeting of USA and Canadian National Committees of URSI and the IRE Professional Group on Antennas and Propagation, National Research Council, Ottawa, Canada.

OCTOBER 14-17-Audio Fair and Audio Engineering Society Convention, Hotel New Yorker, New York, N. Y.

OCTOBER 26-28-IRE-RTMA Radio Fall Meeting, Toronto, Ontario.

NOVEMBER 13-14—Annual Electronics Conference, Kansas City Section, IRE, Hotel President, Kansas City, Mo.

NOVEMBER 18-20 — Joint IRE-AIEE Sixth Annual Conference on Electronic Instrumentation in Medicine and Nucleonics, New York, N. Y.

FEBRUARY 4-6, 1954 - Sixth Southwestern Conference and Electronics Show, Tulsa, Okla.

MARCH 22-25, 1954—Radio Engineering Show and IRE National Convention, Kingsbridge Armory and Waldorf-Astoria Hotel, New York, N. Y.





News Briefs

(Continued from page 18)

Sylvania Electric Products Inc. This member of a Sylvania production team is shown soldering a wafer of germanium to a triode transistor mounting post. After a delicate lead wire is at-



tached to a dot of the rare metal, the assembly job is completed except for capping and hermetically sealing the transistor.

SILICON ALLOY DIODE

Revolutionary advances in telephone switching systems and in many kinds of computers may result from the new electronic device which has been created by Bell Telephone Laboratories. Described as a silicon alloy junction diode, it serves as the electronic equivalent of a tiny one-way switch, thus acting as a rectifier, and is capable of operating thousands of times faster than its mechanical counterparts.

Like the transistor, the silicon alloy diode requires no warm-up period. But unlike the present germanium transistor or diode, it can operate well under high temperatures. The ratio of its resistances is 100,000,000 to 1. Production problems are being worked out with the Western Electric Company, manufacturing unit of the Bell System.

Remote Amplifier

(Continued from page 16)

In operating the "Sports Special," better low frequency response has been noted when the primary of the output transformer is isolated from the d.c. current. The isolating choke is the primary of a midget universal output transformer. The blinker circuit makes use of a NE51 bulb; C_1 determines the rate of flashing, and this condenser must have a minimum of leakage.

No feedback scheme was employed in this circuit, as the over-all gain is not enough to allow for inverse feedback.

> Nevertheless, the frequency response is excellent, being of the order of 50-12,000 cps \pm 1 db. Of course, the response depends on the transformers used. Distortion measurements indicate the percentage to be well below 5% at 0 db and 50-12,000 cps. Battery life is normally 25 hours or more.

Extension wire for the telephone line is wound on two ears mounted on the back of the unit. With the WE 633 microphone plugged in. only headphones and a screwdriver are needed for a remote pickup. This remote amplifier has proven dependable in every respect at WKDK for the past two years.



TECHNICA

"FUNDAMENTALS OF ELECTRON MOTION" by Willis W. Harman, A ciate Professor of Electrical Enginging, Stanford University. Published McGraw-Hill Book Company, Inc., West 42nd Street, New York 36, N 319 pages. \$6.50.

This is a book for the user of elected tubes—for the student whose pringing is to gain general understand rather than specialized information contains the essential philosophy of a tron tube analysis.

In the first chapter, the basic 1 which govern the motions of free entrons are reviewed and summarized, remainder of the book is then concent with their application in determine electron motions under various circumstances, and from this knowledge, in riving the external, measurable chapteristics of electronic devices. Empry throughout is not on the devices the selves but upon the methods emply in their analysis.

The numerous problems form a a important part of the book. No inknowledge of mathematics beyond culus is assumed, however; the man matical techniques are explained as i are needed.

"CIRCUIT THEORY OF ELECTRON VICES" by E. Milton Boone, Profes of Electrical Engineering, The State University. Published by Wiley & Sons, Inc., 440 Fourth Aver New York 16, N. Y. 483 pages. \$8.53

Most of the material included ini book has been used during the past years in note form by students enra in the engineering and engineer physics curricula at The Ohio & University. It is sufficient for a a semester course.

Fundamental emphasis is on circ theory and not on the physics of elected devices inasmuch as the author belief that for the beginning student analyshould be limited at first to the circ properties of the electron devices—perties that can be determined by nurements at available terminals. Selectron and ion physics is necessed but this material has been integrated the circuit theory.

The vacuum tube and the transpass operated in the linear region of characteristics have been treated four-terminal networks using the eral admittance or impedance pasters of four-pole theory. A compactant of the compact is included on the linear city theory of transistors.



Products

nued from page 23)

The sharp null may be obtained frequency from 100 cps to 50 kc. filter is useful for any audio or nic work requiring selective amon and for stabilization of a.c. A descriptive pamphlet is available request from Krohn-Hite Intermediate Company, 580 Massachusetts C. Cambridge 39, Mass.

OKE

proration of a high-permeability core in the newly developed b" r.f. choke has provided a raving excellent operating characters and extremely small size. Innounced by the Grayburne Corno, 4-6 Radford Place, Yonkers, it is especially recommended for computer circuits and other appons where component size is a factor.

otrical characteristics of the "choke are as follows: d.c. snce—120 ohms; inductance—25 the 5%; distributed capacity—8 Q at 100 kc.—115; Q at 450 kc. cand current-carrying capacity—

WERMINED COUNTER

ersatile electronic predetermined ir has been designed by the *Potter* cment Company, 115 Cutter Mill



Great Neck, N. Y., for use whereorecise, multiple-sequence control anufacturing processes is desired. Used production and reduced spoilan be achieved with this counter ise it is possible to govern the open of production machinery in of linear measurement, shaft rations, quantity, volume, or weight perational speeds as high as 60,000 minute.

c four-sequence counter illustrated is one of a complete line of prededed counters available for one or sequences. Each channel may be for any number from 0 to 9999.

Switching through the four channels is automatic at the end of the count.

LOG LINEAR CONVERTER

Pickard & Burns, Inc., 240 Highland Avenue, Needham, Mass., has announced the availability of the Model 86 log linear converter. This unit produces a true logarithmic relationship between



any 50-kc. output or i.f. and the Model 86 meter reading, thus providing the user with means of recording up to 100 db on conventional linear recorders. Any portion of this 100-db range may be quickly expanded by push-button selection to give a full scale reading of 20, 40, 60, 80 or 100 db. Because of the logarithmic relationship, it is possible to read and record voltage changes of 100,000 to 1 without decading.

REMOTE CONTROL SYSTEM

The Hammarlund Manufacturing Company, Inc., 460 West 34th Street, New York 1, N. Y., has introduced a control system for unattended broadcast transmitters which meets the recently announced FCC regulation concerning such equipment. It is built on a high degree of flexibility and designed on building block principles, with Hammarlund control and supervisory unitized components.

Basic features of the system are: (1) only a single a.f. telephone circuit is required—v.h.f. or microwave may be used, but no d.c. circuit is needed; (2) full control of up to nine separate circuits is provided, as well as (3) remote telemetering of nine separate electrical quantities; (4) up to four emergency alarm indications are included, and (5) fail-safe operations are assured at all times.

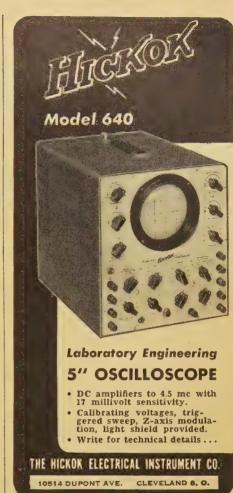
PHOTO CREDITS

PAGE CREDIT 5, 6, 7, 14, 15, 32. National Bureau of Standards

9, 10..... Central Electronics, Inc. 13..... Bendix Radio

ERRATUM

In the circuit diagram of Fig. 2, p. 16, of the August Issue ("Remote Temperature Measurement"), switch S₁ should be connected to the bottom end of the 100,000-ohm resistor instead of to the top end.







By NORRIS HEKIMIAN

National Bureau of Standards

PROVIDE more reliable and sensitive receiving and recording instruments for communications signals, the National Bureau of Standards has for some time carried on a continuous program of research and development in this field. The most recent product of the program is a comparatively simple frequency deviation meter developed at the NBS Central Radio Propagation Laboratory. This instrument indicates the deviations of a signal from a reference frequency to better than 0.5%.

As is true of most frequency deviation meters, the circuit of the NBS instrument consists of a limiter-discriminator arrangement and provision for driving an indicating device from the discriminator output. Normally, the arrangement includes two stages of limiting, one of discrimination, and a driving stage. However, by employing the new 6BN6 gated-beam tubes, it has been possible to reduce circuit complexity and to hold the tube complement to two in number. Advantage is taken of the input-output characteristic of the 6BN6 tube-which rises sharply to an equilibrium level, as in a step function-to obtain the second stage of limiting combined with quadrature-grid discrimination. The indicating device—a 150-0-150 microammeter -is driven through a d.c. bridge circuit by the current resulting from an unbalanced condition in the plate circuit of the discriminator.

To avoid plate-current cutoff by selfbias, which is possible with gatedbeam tubes, the circuit employs 60-mhy. chokes in the signal grid returns of the 6BN6 tubes. Low-value resistors are placed in the plate leads to help dampen the plate surges and to aid in obtaining a flat limiter characteristic.

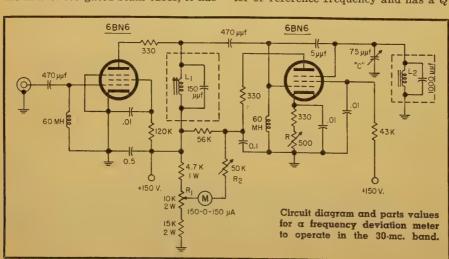
The d.c. bridge resistors in the indicator circuit are of adequate wattage and sufficiently well ventilated to avoid changes in resistance from overheating. The tank coil in the plate circuit of the first stage is set to resonate at the center or reference frequency and has a Q of about 60 when adjusted on a m external to the circuit. The quadrata grid tank coil also resonates near center frequency and has a Q of when measured out of the circuit.

The NBS circuit has two inher disadvantages: (1) Because the rent flow in the grid of the first 61 is limited, the input impedance of meter varies with the level of the is signal and has a minimum valuabout 10,000 ohms. This relati large minimum is generally accepts but a low-output impedance driv such as a cathode follower-may used when necessary as a buffer bety the signal source and the devise meter. (2) Like many other discr nators, the NBS unit shows consider ble interaction between discrimin adjustments. This often require tedious and prolonged initial aligi procedure; however, the operation r be performed only once when a meter is to be used at a fixed frequen

Calibrations may be performed several ways, depending on the ec ment that is available. When a calibrated signal generator is use is necessary to calibrate only the put indicating meter directly ag: the input frequency of the signal erator. The input to the devise meter should be set to at least 2.0

during the calibration.

One of the NBS frequency deviate meters was used during a 1600continuous life test to determiner difference between the local and si oscillators in two 30-mc, receivers the conclusion of the examination deviation meter showed a chang less than 200 cycles, which was 1 ably due to changes in the cr oscillators of the receivers. No ad ment to the deviation meter was n sary after the initial calibration.



utperform on ALL Channels!

in that is greater by far than that offered by best of the collinears, conicals and multinent Yagis, is now offered by famous TRIO 3-ZAG antennas!

sensational new TRIO development—a representant type impedance matching network—makes possible this tremendous impresent by providing an almost perfect redance match to the line on every channel! like isolation filters, the ZIG-ZAG represent network has NO insertion loss!

single feed-line is used, even when stacking all-channel operation!

Extensive tests were made in all sections of the country, in every conceivable type of terrain. Results prove that the ZZ12L, ZZ16H combination, with their associated re-entrant networks, provides the finest all VHF channel, single lead-in operation yet obtained.

Current shipments of TRIO ZIG-ZAG antennas include the complete network.

For channels 2 thru 6 or channels 7 thru 13 separately, or combined for channels 2 thru 13, TRIO ZIG-ZAG antennas are the hottest ever designed.

New descriptive literature available.

HIGH GAIN TRIO UHF ANTENNAS

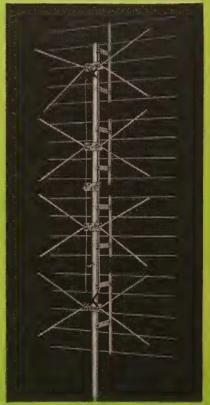
UBT BOW-TIE SERIES

(4-stack, in actual tests, bests all other types)

popular TRIO 4-stack bow-tie, ctual field tests, outperformed all trypes because it takes advante of the fact that UHF signals are aposed of closely spaced layers different signal strength. Because the taps one or more of these varythigh density layers at all times—ors consistent high gain day in day out.

D bow-ties offer high forward in without sacrificing excellent ct-to-back ratio and good line match. Adoption of reflectors using individual horizontal elements eliminates vertically polarized noise pick-up so often encountered with grid, mesh and solid type reflectors.

TRIO bow-ties are also available in 2-stack and single stack models. The 4-stack and two stack come assembled on 4 foot and 3 foot aluminum masts respectively, with phasing harness installed. The single bay model is furnished assembled on a 2 foot aluminum mast.





Manufacturing Co.
GRIGGSVILLE, ILLINOIS

Do as TV manufacturers do ... use Hi-Vo-Kaps



Centralab

Cayas
CENTRALAB, A Division of Globe-Union Inc. 910-J E. Keefe Ave., Milwaukee 1, Wis.
Please send me latest technical data on Centralab's Ceramic TV Hi-Vo-Kaps.
Name
Firm
Address
CityStateState

Within the INDUSTRY

COMMANDER R. C. SERGEANT, USNR, is the new technical division officer of

the Navy's Electronic Supply Office, Great Lakes, Illinois. His work will include technical and engineering research relating to procurement, inventory control, and distribution of electronic Supplementary.



tronic control. He will also serve as liaison officer between the Navy and the electronics industry.

The Electronic Supply Office is the control point of the entire electronic supply system of the U. S. Navy.

Before entering the Naval service in 1940 he was employed by the *Mackay Radio and Telegraph Company* as radio supervisor of the San Francisco office.

KARL W. JENSEN. vice-president of *Jensen Industries*, *Inc.*, Chicago, has been elected chairman of the Association of Electronic Parts & Equipment Manufacturers, trade association of 120 midwest firms.

Theodore Rossman, general manager of *Pentron Corporation* was elected vice-chairman, the position formerly held by Mr. Jensen. Mr. Jensen succeeds Francis F. Florsheim as chairman.

Helen Staniland Quam, distributor sales manager of *Quam-Nichols Co.*, was re-elected treasurer of the association for her sixteenth term. Kenneth C. Prince was renamed executive secretary.

THOMAS A. EDISON, INCORPORATED has purchased MEASUREMENTS CORPORATION of Boonton, N. J., and will operate the company as a wholly-owned subsidiary. No basic change in policies or personnel is anticipated . . LA POINTE ELECTRONICS INC. of Rockville, Conn., has purchased CIRCUITRON, INC., manufacturers of printed circuits.

RTMA has announced a change in the Association's name to the Radio-Electronics-Television Manufacturers Association (RETMA) and the approval of a reorganization plan which will expand the board of directors and provide larger representation for new segments of the industry, especially in the advanced electronics field.

Under provisions of the by-law amendments and in accordance with the action taken by the board of directors in Chicago, two committees of the board were established. They are the radio-television industry committee and the electronics industry committee. Each director will be asked to select one of the two committees a representing his major interest and will be permitted to designate an atternate to serve on the second committee providing his company is engaged in the manufacture and sale of products or services within the sphero of that committee.

The Association also announced the establishment of a West Coast officin Los Angeles. Joseph J. Petersowill head the new office.

willys motors, INC. has announce that its electronics division is entering the television transmitter field thelp speed opening of the some-200 authorized u.h.f. TV stations.

The company is planning to offer: "TV package" consisting of a 100 watt transmitter (operating from 45 to 900 mc.), camera, projector, cossole, panel, etc. to licensees in area of 50,000 population or less.

The company is also working with the National Association of Eductional Broadcasters to develop a transmitter that meets the special requirements of educational TV systems.

BERNE FISHER has been named directed of engineering for Standard Coil Products Co. Inc.

Mr. Fisher, who holds a number of mechanical and electrical patents relating largely to television e quipment, has been associated with General Instrument



Corporation for the past eighter years, most recently as chief enginerand production manager.

The company makes televisii tuners and through its subsidial Kollsman Instrument Corporation, a major producer of aviation instruments and systems.

WINCHARGER CORPORATION of Sion City, Iowa, will build a new manufaturing plant on high ground away from the danger of flood waters that cause considerable damage to the plant is June. The new plant will have a flot space of 300,000 square feet, more thanked the space occupied by the prent factory . . . RESDEL ENGINEER CORPORATION is building an additional plant of 21,000 square feet at 36 San Fernando Road, Glendale, Califnia. The firm is presently located 2351 Riverside Drive, Los Angeles California . . . MOSLEY ELECTRONING. of St. Louis has moved all executive.



TRAIN FASTER—TRAIN BETTER—TRAIN EASIER
IN 10 MONTHS—OR LESS—FOR

RADIO—TELEVISION

Our 21st Year Training Men for Greater Incomes and Security in Radio-Television

S BIG KITS

Radio Television parts and equipment, uch of your training will be actual construction and experimentation . . . the kind of truly RACTICAL instruction that prepares your your Radio-Television career.

Frank L. Sprayberry
President
Sprayberry Academy
of Radio

NEW! NO OBLIGATION PLAN

You Have No Monthly Payment Contract to Sign Pay For Your Training as You Earn and Learn

You can get into Radio-Television, today's fastest growing big money opportunity field, in months instead of years! My completely new "package unit" training plan prepares you in as little as 10 months or even less! No monthly payment contract to sign—thus NO RISK to you! This is America's finest, most complete, practical training—gets you ready to handle any practical job in the booming Radio-Television industry. Start your own profitable Radio-Television shop... or accept a good paying job. I have trained hundreds of successful Radio-Television technicians

during the past 21 years—and stand ready to train you, even if you have no previous experience! Mail coupon and get all the facts—FREE!

Valuable Equipment Included
With Training

The new Sprayberry "package" plan includes many big kits of genuine, professional Radio-Television equipment. You perform over 300 demonstrations, experiments and construction projects. You build a powerful 6-tube 2-band radio set, multi-range test meter, signal generator, signal tracer, many other projects. All equipment and lessons are yours to keep . . . you have practically everything you need to set up your own profitable Radio-Television service shop.

Earn Extra Money While You Learn!

All your 10 months of training is IN YOUR HOME in spare hours. Keep on with your present job and income while learning. With each training "package" unit, you receive extra plans and "Business Builder" ideas for spare time Radio-Television jobs. New television stations everywhere, open vast new opportunities for trained Radio-Television Technicians—and those in training. If you expect to be in the armed forces later, there is no better preparation than practical Sprayberry Radio-Television training.

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MAIL COUPON TODAY! NO OBLIGATION

YOU BUILD the Television set and the powerful superhet radio receiver shown above. IN ADDITION to the other test units shown here (many are not shown because of lack of space). All equipment I send you is YOURS TO KEEP.

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I invite you to get all the facts—
FREE YOU 3 BIG
RADIO-TELEVISION BOOKS

I want you to have ALL the facts about my new 10-MONTH Radio-Television Training —without cost! Rush coupen for my three big Radio-Television books: "How to Make Money in Radio-Television." PLUS my new illustrated Television Biolicitin PLUS an actual sample Sprayberry Lesson—ALL FREE. No obligation and no salesman will call. Mall coupon NOW!

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Please rush to me all information on your 10-MONTH Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Be sure to include 3 books FREE.

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THE FISHER HI-LO FILTER SYSTEM . MODEL 50-F

PROFESSIONAL AUDIO EQUIPMENT AT

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FISHER **Hi-Lo Filter System**

Here it is at last-America's first electronic sharp cut-off Filter System. Suppresses turn-table rumble, record scratch and distortion, etc., with the absolute minimum loss of frequency response. Separate low and high frequency cut-offs. Can be used with any tuner, preamplifier, amplifier, etc. No insertion loss. Uniform response 20-20,000 cycles, ± 0.5 db. Selfpowered. All-triode. Beautiful plastic cabinet.

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Preamplifier-Equalizer

Now, professional record equalization facilities are within the reach of every record collector. THE FISHER Model 50-PR, like its big brother (Model 50-C) is beautifully designed and built. Only \$19.95

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OUTSTANDING FEATURES

• Independent switches for low-frequency turnover and high frequency roll-off. • 16 combinations. • Handles any low level magnetic pickup. • Hum level 60 db below 10 mv input. • Uniform response
20-20,000 cycles, ± 1 db. •
Two triode stages. • Full low frequency equalization. • Output lead any length up to 50 feet. • Beautiful plastic cabinet, etched brass control panel. • Completely shielded chassis. • Built-in AC switch. Jewel indicator light.

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tive and general offices into new quall ters at 8622 St. Charles Rock Road, S. Louis 14, Missouri . . . CHICAGO TELE PHONE SUPPLY CORPORATION has come pleted and equipped a new, moderly building which adds 64,182 square feet to its manufacturing and office space in Elkhart, Indiana . . . SKYLINE MF@ co. has increased its plant area ; 1458 E. 17th St. in Cleveland, Ohio, t. 25 per-cent. The new space will t used for the increased production of u.h.f.-v.h.f. antennas . . . DESIGNER FOR INDUSTRY, INC. has expanded in engineering and research facilities is a newly-renovated building at 3107 Del troit Avenue, Cleveland. The new plan adds 8000 square feet to the company development and manufacturing are . . . AUDIO DEVICES, INC. has expand ed its plant and factilities in Gleil brook, Conn., to permit stepping [production of recording tape by least 50 per-cent . . . TELETRONIC LABORATORY, INC. has recently core pleted the construction of a new engi neering building located adjacent to in manufacturing plant on Kinkel Stree Westbury, L. I., New York TF HERLEC CORPORATION, midwested manufacturing subsidiary of SPRAGE ELECTRIC COMPANY has moved all its operations to its new plant at Gran ton, Wisconsin. The new facility is li cated in a rural area about 25 mili from the company's former location r the heart of downtown Milwaukee THE HALLICRAFTERS COMPANY h begun construction on a new \$400,0, plant in Toronto, Ontario. It is e

pected to be in operation by Octo

ROSCOE A. AMMON, for twelve year general manager and chief enginer

of the Marion Electrical Instrument Company of Manchester, N. H., has now become president and principal stockholder of the corporation.

He succeeds William F. McElroy

who will retire from active manag ment but continue to serve as a dire tor and in an advisory capacity. N Ammon assumes the duties of predent and treasurer while Herbel Schachat will serve as vice-presided in charge of operations.

The company makes a complete li of electrical indicating instruments.

EDWIN E. FREED has been named mam ger of operations of General Instri ment Corporation's headquarters plai in Elizabeth, N. J. . . . ROY E. NE SON, veteran of RCA engineering at sales activities, has been promoted: the newly-created post of manager semi-conductor equipment sales for t Tube Department of the RCA Victo Division . . . DR. WILBUR A. LAZIZ has been named vice-president altechnical director in charge of t Sprague Electric Company's researt

RADIO & TELEVISION NEW



sweep. This means that the output of the generator will sweep from 22 mc. to 26 mc. or over the specified range of 4 mc. This sweeping signal would then be applied to the input of, say, a video i.f. system. Here, each portion of the signal would be treated according to the characteristics of that system. It might be, for example, that the 22 mc. portion of the signal would receive more amplification than the 26 mc. portion, in which case the 22 mc. voltage would be stronger at the output of the system than the 26 mc.

signal. This variation in amplitude of the various signals will be detected at the video detector (which is an AM detector) and then presented on the screen of an oscilloscope.

Now, although the sweep generator is an important service tool, it seems to be one of the most difficult to operate. Part of the difficulty stems from the fact that it must be used in conjunction with an oscilloscope which is, in itself, somewhat complex; and

* Oscilloscopes-The Electronic Eye of the Service Technician" by M. S. Kiver. January, 1953.

part of the trouble is undoubtedly du to the bewildering array of responpatterns that can be produced if the instrument is not properly set up.

Oscilloscopes and their operation have already been covered in a previous issue of this magazine*. Hence here, we will turn our attention the front panels of today's sweep generators in order to note what the contain and what each control doe

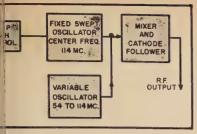
Sweep Generator Frequency Dia The main control is the frequence dial. This tells you to what center

Table 1 Performance data on commercially-available TV sweep generators as received direct from the manufacturers,

Make and Model	Freq. Range	Blanking Control	Internal Marker Gen.	Sweep Phase Reversal Sw.	Price	Remarks
Eico Model 360	500 kc 228 mc.	No	See Note 1	No	\$34.95 (kit form)	External binding post for conection of an external mark generator.
General Electric Model ST-4A	4-110 mc. 170-220 mc.	Yes	No	Yes	\$395.00	Strong, flat output, low lea age, and good attenuatio Wide range of phase contro
Hickok Model 610A	0-115 mc. 150-230 mc.	No	Variable from 19-48 mc.	No	\$219.00	Special FM scale for swe width control. Crystal osc. at ext. crystal jack. Absorption type marker plus regular pitype marker.
Jackson Model TVG-2	2-108 mc. 174-216 mc.	Yes	Variable from 4-216 mc.	Yes	\$245.00	Separate crystal osc. and excrystal socket. Provision for video mod. of marker signal calbration. 400-cycle AM mod lation of marker signal. Two three marker pips can used simultaneously.
Philco Model 7008	4-120 mc. 145-260 mc.	Yes	Variable from 3.2-250 mc.	No	\$466.00	Contains separate scope wit 3" screen. 400-cycle mod. marker gen. Scope may used externally. Internal crytal calibrator.
Precision Model E-400	2-480 mc.	Yes	See Note 1	Yes See Note 2	\$133.03	Special FM scale for swewidth control. Internal crystal osc. with provision for ext. crystals. Ext. AM mod. r.f. signal possible, if desire Panel terminal for marker sinal injection.
RCA Model WR-59C	0-50 mc. continuous. Channels 2- 13 preset	Yes	No	No	\$274.50	Strong, flat output, low lea age, wide attenuation rang linear sweep, terminated ou put cables.
Simpson Model 479	2-120 mc. 140-260 mc.	Yes	Variable from 3.3-250 mc.	No	\$325.00	400-cycle AM modulation marker gen. Internal crystosc. for calibration, low signleakage. Harmonics of Al FM generators said to be useful in u.h.f. TV range.
Simpson Model 480	Same as Model 479 with addition of built-in 3" scope. \$475.00					
Sylvania Model 500	2-230 mc.	No	No	No	\$139.50	Narrow- and wide-band sweet Good attenuator contre Good output.
Triplett Model 3434-A	0-240 mc.	No	Variable from 3.5-4.9 mc. 19.5-48.6 mc. Harmonics to 241 mc.	No	\$199.50	Internal crystal osc. with a crystal socket. Bar general for vert. linearity adjustmer Provides absorption and p type markers, 600-cycle moulation of marker generat.

Note 1: These generators have an internal crystal oscillator. By inserting the proper crystals via a front panel sockel various fixed marker frequencies can be obtained.

Note 2: The sweep width control has a center zero position that permits the operator to reverse the horizontal direction of the response curve.



A. Simplified block diagram of sweep rator shown in Fig. 1D. This arrangeprovides output frequencies from 500 228 mc. without using bandswitch.

ency the instrument is set. Thus, dial is positioned at 26 mc., then utput sweep frequencies will vary ual amount above and below this Just how much variation will depends upon the setting of ancontrol, known as the sweep control.

eral representative front dials whown in Fig. 1. The dial shown g. 1D has all of its ranges exand the desired frequency is hed by setting the hairline over roper figure. The frequency range able from this sweep generator ds roughly from 500 kc. to 228 The bottom scale is a reference marked from 0 to 100 linearly. lext three scales, marked "center frequencies," are calibrated 0-60, 0-120, and 168-228 mc. The most scale is an internal oscilhaving a range of 54 to 114 mc. w, the rather surprising thing this particular instrument is all output ranges are available but bandswitching. This is ved by the arrangement shown g. 2. An oscillator with a fixed ency of 114 mc. is frequency lated to a maximum sweep width mc., sweeping this fixed oscilback and forth from 99 to 129 The amount of frequency modun is controlled by the sweep width ol setting.

e output of the fixed sweep oscilis mixed with that of a variable cator. This second oscillator can ned to any frequency between 54 114 mc. by rotating the main g dial pointer. The resulting between these two oscillators fixed and frequency modulated the other variable) provide the

frequency ranges of the instrument. For example, the "difference" fre-

quencies between the 114 mc. fixed oscillator and the 54-114 mc. variable oscillator provide the frequency range of 60 to 0 mc. The "sum" frequencies of the two oscillators provide the range of 168 to 228 mc. The second harmonic of the "difference" frequencies gives the range 120 to 0 mc.

In the dial shown in Fig. 1A the hairline indicator is kept stationary and the dial is rotated. The various frequency ranges are selected here by means of a band selector switch and, in general, this is typical of most sweep generators using continuous

The illustration of a third dial, Fig. 1B, represents still another approach to this problem. Here, the main tuning dial is a thirteen-position selector switch. The first position is marked "0-50" (mc.) and in this position frequencies up to 50 mc. may be obtained from the instrument. Just precisely which frequencies is determined by another control which has markings on it of 5, 15, 25, 35, and 45. This second control thus enables the user to set the frequency at any point within the 0 to 50 mc. range. The five numbers are positioned at appropriate points around the rotational range of the second control in order to indicate approximately where the various frequencies may be obtained. In actual practice the service technician would rotate the second control until a response pattern appeared on the scope

As the reader undoubtedly knows,

Hickok's Model 610A generator unit.



Precision Apparatus Co.'s Model E-400 television service sweep generator.



Electronic Instrument Company's (Eico) Model 360 unit available in kit form.



The Model ST-4A by General Electric.

Radio Corporation of America's WR-59C.



The Model 480 "Genescope" by Simpson.



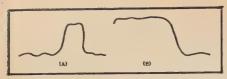


Fig. 3. When the sweep is too wide, the pattern will tend to crowd together (A). When too little sweep is used, the full pattern may not be obtained as shown in curve (B).

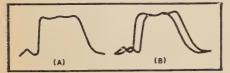


Fig. 4. (A) Desired single pattern response curve. (B) Double trace pattern obtained before phase control adjustment.

the 0-50 mc. range is employed for aligning the i.f. systems of television receivers. Then, for the r.f. frequencies of the twelve v.h.f. channels, the selector switch is set to the appropriate position. This particular arrangement possesses the very desirable advantage of simplicity. It can suffer if the circuit design is not sufficiently stable to maintain the various frequencies within the range specified at each position. Should this happen (and it may occasionally), then a series of internal adjustments are provided which the technician himself can perform.

The final dial illustration, Fig. 1C, employs a drum arrangement in which the frequency ranges are marked off around the outer surface of the drum. To choose the desired frequency, the drum is rotated until the appropriate figure is positioned directly underneath a fixed hairline indicator.

Sweep width control: Associated with the main tuning dial, and used in conjunction with it, is the sweep width control. The setting of this control determines the extent of the signal sweep about the frequency chosen by the main dial. On some instruments, the control has a scale marked off from 0 to 10, or 15, or 30 depending upon how great a sweep can be obtained with the instrument. On other generators, the scale is omitted. Actually, the markings on a scale, when used, are approximate anyway and most technicians seldom pay much at-

tention to them. They simply adjust the control until the full pattern is observed on the screen. Too much sweep will tend to narrow or crowd the pattern together (Fig. 3A); too little sweep will not bring the full pattern to the scope screen (Fig. 3B). The former, of course, is more desirable than the latter, but with a little practice it is not difficult to obtain the proper amount of sweep.

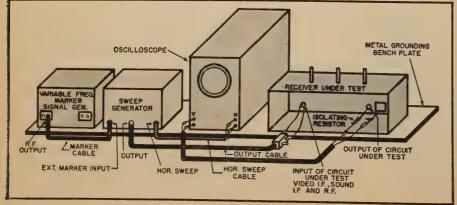
Incidentally, sweep values, when given, refer to the total width and not that which is swept out on either side of the center frequency. For example, setting the sweep width control to 10 mc. and using a center dial frequency of 24 mc. means that the output frequency will vary from 19 mc. (24-5) to 29 mc. (24+5).

Many television sweep generators are also capable of covering the FM r.f. range (88 to 108 mc.) and the FM i.f. range (10.7 mc.). Where this is true, a second scale is frequently inserted around the sweep width control knob, extending from 0 to 1 or 1.5 mc. A 1-megacycle sweep is adequate for the alignment of FM circuits and as a convenience to the user, this special range permits him to set the sweep control more easily. A special switch is usually available and when the generator is to be used on FM, the switch is flipped over and then the sweep width control deals with its FM scale (0 - 1 or 1.5 mc.) rather than the TV scale (0 - 10, 15, or 30 mc.).

It is, of course, perfectly possible to employ the same sweep width scale for both FM and TV receivers. The only precaution necessary is to see that the control is set to approximately 1 megacycle for FM. Providing a separate control variation for FM is a convenience; it is not, however, absolutely necessary.

It is interesting to note that when the sweep width control is set at zero, the signal output of the generator is simply a single r.f. frequency determined by the setting of the main dial. Thus, although the technician seldom uses his sweep generator as an r.f. generator, it does possess this facility. One manufacturer even goes so far as to provide input terminals to which an audio signal can be applied in order that the generator output may be amplitude modulated.

Fig. 5. Service bench setup showing how sweep generator is connected to receiver.



Possibly one reason why service technicians seldom use their sweet generators for single signal applica tions is because less emphasis i placed on dial marking accuracy in these units. Sweep generators are de signed primarily to produce a response pattern on a scope screen and an ac curate r.f. generator is then brough in for the purpose of supplying suit able identifying markers. As long a the sweep generator produces the de sired response trace, its obligation is fulfilled and no one particularly care whether or not the dial markings are accurate. However, when employed as an r.f. generator, frequency accuracy does become important and now close attention is paid to the dial setting There is, of course, no reason why the dial markings of a sweep generator should not be correct and many are But as a whole, they are less reliable than comparable AM generators.

The strength or amplitude of the output signal of the sweep generator is controlled by an r.f. output (or r.f. attenuator) potentiometer. Sometimes this is the only control; at other times it is accompanied by a coarse selector switch attentuator possessing steps of X1, X10, X100, X1000, and X10,000. Whatever the arrangement, the technician will find that the controls are usually kept much closer to their maximum positions than they are to their minimum positions.

Phase control: The phase control which is found on the front panel devery sweep signal generator, has function which is probably least understood and has, consequently, cause more trouble than any other control on the instrument.

First off, let it be stated that unt: a response pattern of the circuit under test is obtained on the scope screed no attention is paid to the phase con trol. Once the pattern is developed however, the phase control is rotate until a single trace, or as close as the technician can come to a single trac is obtained. Thus, suppose the circu receiving the sweep signal is the vidi i.f. system of a television receive Then its normal response pattern ma be that shown in Fig. 4A. However when the sweep generator and osc: loscope are first hooked up to the ? chassis, chances are the initial 1 sponse pattern developed on the screen would be as shown in Fig. 4B. By 1/2 tating the phase control, the two pa terns can be made to blend, giving to trace shown in Fig. 4A.

The phase control, then, is a confidence rective control, designed to bring the beam deflection of the scope in st with the frequency sweeping voltation obtained from the generator.

This leads us directly to another terminal on the front panel of 1 sweep generator. This terminal known by such names as "Hon Sweep", "60-Cycles", "Phase 60 c"Horizontal CRO Input", "Scope", "Sync", provides a sinusoidal 60-cycletage which is connected to the h

(Continued on page 200)

IE NOVICE STATION RECEIVER

By ARRY TROMBLY, WØDCB

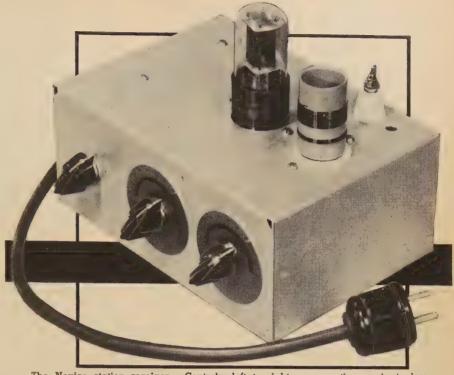
and

RT A. HATHAWAY, WØGTK Walter Ashe Radio Company

first article of this series deribed a transmitter and power oply. Including the receiver to scribed here, these three units built for less than \$50.00. This ter, although quite simple and occurrents almost forgotten in tomanateur receivers, exceeds extions and gives an excellent that of itself in the crowded

receiver uses a 6SN7 tube, one in of which acts as a regenerarefector, and the second section transformer-coupled stage of amplification. One of the reafor the good performance of this ier is the use of regulated plate e, which is furnished by the VR in the power supply described in 1. Crystal-controlled signals the way they should, rather the way they did in most regenter receivers of twenty years ago it was hard to tell whether you flistening to crystal control or self-excited oscillator.

the parts of this unit are ted on a 5"x7"x3" chassis. Their on can be seen from a study of notographs and there is nothing all about the placement of these Since it was desired to keep ming condensers inside the chaswas not feasible to use a verdial. However, the use of a coil and a low-capacity varieondenser for bandspread tuning



The Novice station receiver. Controls, left to right: regeneration, main tuning, bandspread. Hole near antenna insulator is for adjusting antenna trimmer. Cable plug fits socket on power supply described last month. 80-meter coil is in place.

Part 2: The receiver. The set uses one tube in a "two-tube" circuit. Performance is very high and construction simple. The transmitter and power supply were described last month.

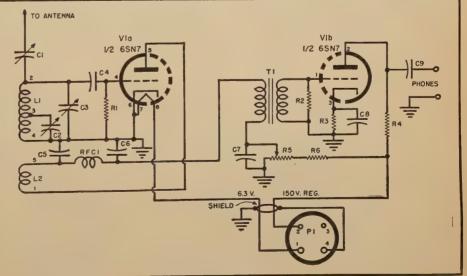
permitted us to give almost 100 dial divisions of bandspread to the 50 kc. 80-meter Novice assignment and also to the 25 kc. 40-meter Novice band. This is more rotation of the tuning control per kilocycle covered than is

offered by many vernier dial arrangements.

To some builders a tapped coil may present something of a problem but there is a way of doing it which (Continued on page 122)

Schematic of the Novice station receiver. Numbers at coil connections refer to pins on coil form, looking at bottom of form. C_2 is the bandspread condenser, C_3 is for main tuning. C_1 compensates for "dead spots" due to antenna resonances.

"-1.5 megohm, ½ w. res.
-150,000 ohm, ½ w. res.
-15,000 ohm, ½ w. res.
-10,000 ohm, 1 w. res.
-50,000 ohm pot.
-33,000 ohm, 1 w. res.
-3-35 μμfd. trimmer cond.
-15 μμfd. var. cond.
-140 μμfd. var. cond.
-100 μμfd. mica cond.
-12 μfd., 150 v. elec. cond.
-10 μμfd., 25 v. elec. cond.
-101 μfd., 600 v. cond.
-1-2.5 mhy. r.f. choke
-80 m.—21½ t. tapped at 10¾ t. from tottom (ground) end to 2¼ t. from bottom (ground) end to 3¼ t. ("tickler" coil)
-80 m.—3¼ t. ("tickler" coil)
-10 coils closewound with #26 en. wire on 1" tiameter, 5-prong coil forms. "Tickler" coils wound at gnd. end of 1, ¼" below 1, All oils wound in same direction.



-6SN7 tube

-4-prong cable plug

-Audio interstage trans., 3:1 ratio

THE KLIPSCH REBEL IV A BACK-LOADING · FOLDED CORNER HORN

By FREDERICK I. KANTOR

G & H Wood Products Co. (Cabinart)

HE speaker system to be described is a new version of the corner horn back-loading type. This general type has been developed independently by several workers, but this specific design stems from the Klipsch series of "Rebels," of which the IV is small enough for substantially any environment-even a monitoring studio-but with big enough performance for highly exacting requirements.

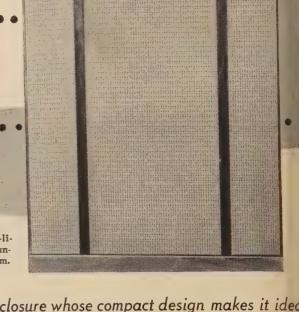
With the majority of loudspeakers suffering a loss of efficiency in the low-frequency region (from 100 cps down) a means of increasing radiation in this portion of the spectrum, without increasing distortion, is of signifi-

cant interest.

At these low frequencies, the loudspeaker's cone action is essentially piston-like. That is, its function is to move a considerable amount of air. To do so, the cone is required to travel farther to generate the same acoustical power than it would be at a higher frequency. At its extreme limit of travel, nonlinearity must occur. At high levels the distortion caused at the bass end will simulate a square wave and give serious intermodulation effects to the middle and highs. Several means have been devised to eliminate this nonlinear effect and increase efficiency in the low-frequency ranges. Comparative evaluations of some of these types and an examination of the workings of the backloaded folded horn will indicate why it is being demanded more and more for critical high-fidelity reproduction.

The present development entails a cavity and slot port, to form a resonant chamber, and a horn coupled to the slot. The slot is loaded by the horn; the proportioning of slot, cavity, and horn provide a base response below about 100 cps which corresponds in efficiency to the front-of-cone direct radiator response above 100 cycles. More complicated horn structures (except high-efficiency, full-range multiple horn systems) have been tried and discarded in favor of this simple and effective device. The function of this

Front view of Klipsch-licensed enclosure being manufactured by the G & H firm.



Details of an enclosure whose compact design makes it ideas for small apartments while providing big-cabinet response:

form of back-loading corner horn may be considered qualitatively in two different ways.

First, think of a bass reflex with a horn acting as a resistive load on the port. The resonances of the system are damped by useful radiation resistance, and the horn does not cost anything as it is formed by the already existing walls of the room at its cor-

Second, think of a horn which is essentially a high efficiency device-if a full horn were applied below 100 cycles, a boomy response would exist. But the cavity-port combination acts as an acoustic low-pass filter, the design of which can be such that the bass range response will correspond

to the mid-range response.

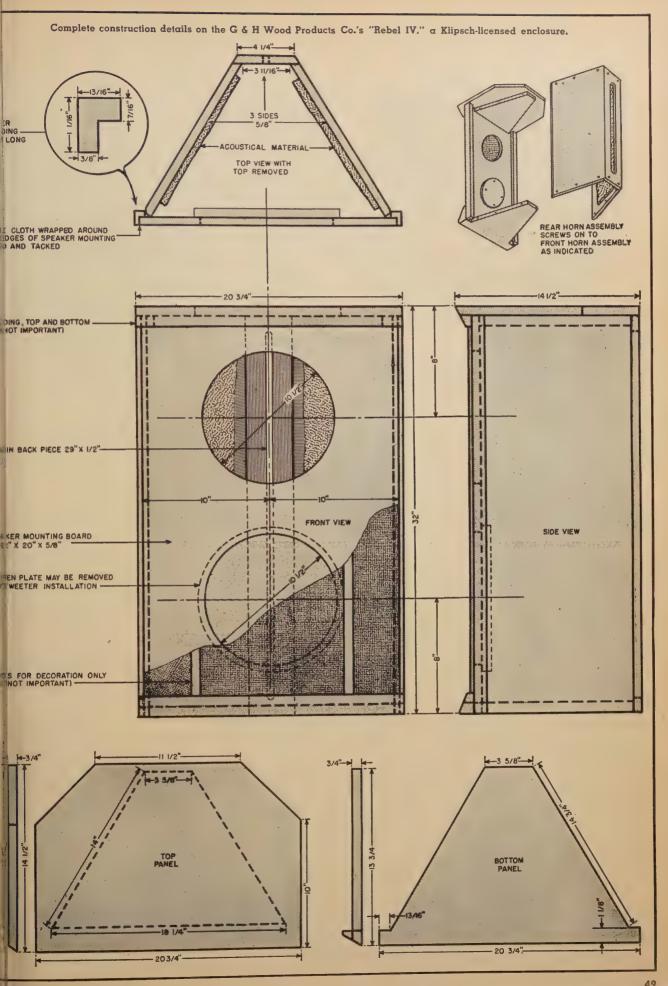
In actual usage, the "Rebel IV's" performance is influenced by few restrictions. The cabinet must be placed flush with the walls of the corner, to maintain the horn flare. This is accomplished easily since the cabinet has no interfering sides and will clear any baseboard or molding. It is, of course, more desirable to mount the woofer in the lower position so that spatial distribution and high frequency absorption will not be influenced by walls, rugs, furniture, etc. The enclosure offers a means of mounting many and varied combinations, i.e., one woofer or coaxial speaker, one woofer and tweeter, a threeway system, etc. This is accomplished by cutting two holes, and covering one with a backing board which is bolted over the additional hole. If you have a 12" speaker you want to mount in

addition to the woofer, just rem this board and install a speaker ini place. If it's a smaller speaker, two er, or what have you, remove board, and cut out the opening to s There is space in the bottom for r crossover system and leads brought to a barrier-type termi board on the outside. The cabine constructed rigidly with ¾" plyw with a unique system of inherbracing to insure no cabinet renances. This also provides quick stallation of components and ren accessibility.

Tested in the home and sound if dios throughout the country, Klipsch "Rebel IV" has been well ceived by a gratifying number of criminating audiophiles and mr lovers. Its low frequency perform ance has enhanced systems with as it should be, clean, no boomy sponses, no noticeable resonances. termodulation effects are redu and its small size and attractive pearance will fit and enhance any ing room environment.

The complete mechanical details this particular unit are included in line drawings on the opposite p All of the dimensions given are ex and should be adhered to for 12-i speakers as well as the various c binations of speakers mentioned lier in the article.

The commercial version of this inet is also available in a size to he a 15-inch loudspeaker as well as in form for both the 12-inch and 15speakers.





Save this handy guide which lists the tubes most often found in TV receivers and their substitutes.

HEN a defective tube cannot be quickly replaced from the service technician's stock technician's stock, the local distributor happens to be out of this number, and the customer is anxious to get his set back, a substitution is often possible. Sometimes another tube type can be plugged into the same socket, adjustment of the circuit might be required, or it may even be necessary to rewire the socket or use an adapter. Whatever means are taken to substitute a different tube

type, the customer should understand that the best performance will be obtained when the correct tube is used and that in most instances a substitute is just what the name impliessomething to take the place of the correct tube.

Occasionally we hear of service technicians who make substitutions, even rewiring parts of the receiver, without informing the set owner. Usually the customer will find this out when he takes his set to another

technician and, whether the rewi portion is really an improvement not, the customer will always distrustful and unhappy. Whene any circuit changes or tube subst tions are made, be sure to expl them to the set owner.

Tube replacements in the r.f. and horizontal sync sections usua require realignment or some readju ment of secondary controls. When slightly different tube type is us this readjustment will also be nec sary. In many instances the use of different tube type is possible would require a change in the cuit. The table of tube substituti given below does not include substitution where a different circ component is also needed or wh extensive rewiring is necessary. the substitutions shown can be m either by direct plug-in, rewiring socket pins only, or else by usin different socket.

Many of the tubes used in TV ceivers are electrically identical have different socket and bulb si For example, the 12AU7 is a 9 miniature tube and is electrically terchangeable with the 6SN7, an o base type. All that is needed to s stitute one for the other is an adap or else removing the old socket mounting a new one. This is o difficult because sockets are rivi to the chassis and in the process

(Continued on page 183)

5V4 5U4,5T4 5 5W4 5V4,5Y3 5	6X4 (plates 3, 5; fil. 7, 8) X4 (plates 3, 5; fil. 7, 8) X4 (plates 3, 5; fil. 7, 8) Y4 (plates 3, 5; fil. 7, 8) 6CB6 (short 2 and 7) 6CB6 (short 2 and 7)	1X2, 7-pin 1B3, octal 5Z3, 4-prong 5Z3, 4-prong 6AH6, 7-pin 6CL6, 9-pin 6S4, 9-pin 6AC7, octal	6N7 6S4 6S8 6SA7 6SE7Y 6SH7 6SH7 6SH7 6SL7 6SL7 6SL8 6U4 6U8 6U3 6V6 6W4 6W6	6SB7Y 6SA7 6SH7 6AX4 6Y6, 6W6 6AX4, 6U4	6SJ7 (short 3, 5)	6AH4, octal 6T8, 9-pin, 7X7 loctal 6BE6 7-pin 6BE6 7-pin 6AU6, 6CB6, 7-pin 6BD6 7-pin, 7A7 loctal 12AX7* 9-pin, 7N7 loct 6S8 octal; 7X7 loctal 6V3 9-pin (top cap) 7C5 loctal; 6AQ5 7-pin 6V3 9-pin (top cap)
1X2 5U4 5U4, 5T4 5 5W4 5U4, 5Y3 5 5Y3 5V4 5 6AB4 6AC7 6AF4 6AG5 6AK5, 6BC5 6AH4 6AH6 6AJ4 6AK5 6BC5 6AL5	X4 (plates 3, 5; fil. 7, 8) Y4 (plates 3, 5; fil. 7, 8) Y4 (plates 3, 5; fil. 7, 8) 6CB6 (short 2 and 7) 6CB6 (short 2 and 7)	5Z3, 4-prong 5Z3, 4-prong 6AH6, 7-pin 6CL6, 9-pin 6S4, 9-pin 6AC7, octal	6S8 6SA7 6SB7Y 6SH7 6SH7 6SK7 6SK7 6SL7 6T4 6T4 6U8 6U3 6V6 6W4 6W6	6SA7 6SH7 6AX4 6Y6, 6W6 6AX4, 6U4	6SJ7 (short 3, 5)	6T8, 9-pin, 7X7 locta 6BE6 7-pin 6BU6 7-pin 6AU6 7-pin 6AU6, 6CB6, 7-pin 6BD6 7-pin, 7A7 locta 12AX7* 9-pin, 7N7 loc 6S8 octal; 7X7 locta 6V3 9-pin (top cap) 7C5 loctal; 6AQ5 7-pi
5U4 5T4 5 5V4 5U4, 5T4 5 5W4 5V4, 5Y3 5 5Y3 5V4 5 6AB4 6AC7 6AF4 6AG5 6AK5, 6BC5 6AH4 6AH6 6AH6 6AH6 6AH5 6BC5 6AL5	X4 (plates 3, 5; fil. 7, 8) Y4 (plates 3, 5; fil. 7, 8) Y4 (plates 3, 5; fil. 7, 8) 6CB6 (short 2 and 7) 6CB6 (short 2 and 7)	5Z3, 4-prong 5Z3, 4-prong 6AH6, 7-pin 6CL6, 9-pin 6S4, 9-pin 6AC7, octal	6SA7 6SB7Y 6SH7 6SJ7 6SK7 6SK7 6T4 6T8 6U4 6U8 6V3 6V6 6W4 6W6	6SA7 6SH7 6AX4 6Y6, 6W6 6AX4, 6U4	6SJ7 (short 3, 5)	6BE6 7-pin 6BE6 7-pin 6AU6 7-pin 6AU6, 6CB6, 7-pin 6BD6 7-pin, 7A7 loctal 12AX7* 9-pin, 7N7 loctal 6S8 octal; 7X7 loctal 6V3 9-pin (top cap) 7C5 loctal; 6AQ5 7-pi
5V4 5U4, 5T4 5 5W4 5V4, 5Y3 5 5Y3 5V4 5 6AB4 6AC7 6AF4 6AC5 6AG7 6AH4 6AH6 6AH4 6AH6 6AH6 6AK5 6BC5 6AK5 6BC5 6AK5 6BC5 6AK5 6BC5 6AL5	X4 (plates 3, 5; fil. 7, 8) Y4 (plates 3, 5; fil. 7, 8) Y4 (plates 3, 5; fil. 7, 8) 6CB6 (short 2 and 7) 6CB6 (short 2 and 7)	5Z3, 4-prong 6AH6, 7-pin 6CL6, 9-pin 6S4, 9-pin 6AC7, octal	6SBTY 6SH7 6SH7 6SK7 6SK7 6SK7 6T4 6T8 6U4 6U8 6V3 6V6 6W6	6SA7 6SH7 6AX4 6Y6, 6W6 6AX4, 6U4	6SJ7 (short 3, 5)	6BE6 7-pin 6AU6 7-pin 6AU6, 6CB6, 7-pin 6BD6 7-pin, 7A7 loct 12AX7*9-pin 12AU7*9-pin, 7N7 loct 6S8 octal; 7X7 locta 6V3 9-pin (top cap)
5W4 5V4,5Y3 5 5Y3 5V4 5 6AB4 6AC7 6AF4 6AG5 6AK5,6BC5 6AG7 6AH4 6AH6 6AJ4 6AK5 6BC5	Y4 (plates 3, 5; fil. 7, 8) Y4 (plates 3, 5; fil. 7, 8) 6CB6 (short 2 and 7) 6CB6 (short 2 and 7)	6AH6, 7-pin 6CL6, 9-pin 6S4, 9-pin 6AC7, octal	6SH7 6SJ7 6SK7 6SK7 6SN7 6T4 6T8 6U4 6U8 6V3 6V6 6W4 6W6	6AX4 6Y6, 6W6 6AX4, 6U4	6SJ7 (short 3, 5)	6AU6, 6CB6, 7-pin 6AU6, 6CB6, 7-pin 6BD6 7-pin, 7AT loct 12AXT* 9-pin 12AUT* 9-pin, 7NT loct 6S8 octal; 7XT locta 6V3 9-pin (top cap)
5Y3 5V4 5 6AB4 6AC7 6AC7 6AC5 6AK5, 6BC5 6AG7 6AH4 6AH6 6AJ4 6AK5 6BC5 6ALS	Y4 (plates 3, 5; fil. 7, 8) 6CB6 (short 2 and 7) 6CB6 (short 2 and 7)	6CL6, 9-pin 6S4, 9-pin 6AC7, octal	6SJ7 6SK7 6SL7 6SN7 6T4 6T8 6U4 6U8 6V3 6V6 6W6	6AX4 6Y6, 6W6 6AX4, 6U4	0501 (snort 3, 3)	6AU6, 6CB6, 7-pin 6BD6 7-pin, 7A7 loct 12AX7* 9-pin 12AU7* 9-pin, 7N7 loct 6S8 octal; 7X7 locts 6V3 9-pin (top cap) 7C5 loctal; 6AQ5 7-p
6AB4 6AC7 6AF4 6AG5 6AG7 6AH4 6AH6 6AJ4 6AK5 6ALS	6CB6 (short 2 and 7)	6CL6, 9-pin 6S4, 9-pin 6AC7, octal	6SK7 6SL7 6SN7 6T4 6T8 6U4 6U8 6V3 6V6 6W6	6AX4 6Y6, 6W6 6AX4, 6U4		6BD6 7-pin, 7A7 loct 12AX7* 9-pin 12AU7* 9-pin, 7N7 loct 6S8 octal; 7X7 loct 6V3 9-pin (top cap 7C5 loctal; 6AQ5 7-p
6AF4 6AG5 6AG7 6AH4 6AH6 6AJ4 6AKS 6ALS 6ALS	6CB6 (short 2 and 7)	6CL6, 9-pin 6S4, 9-pin 6AC7, octal	6SL7 6SN7 6T4 6T8 6U4 6U8 6V3 6V6 6W4 6W6	6Y6, 6W6 6AX4, 6U4		12AX7* 9-pin 12AU7* 9-pin, 7N7 loct 6S8 octal; 7X7 locta 6V3 9-pin (top cap) 7C5 loctal; 6AQ5 7-p
6AGS 6AKS, 6BCS 6AG7 6AH4 6AH6 6AJ4 6AKS 6BCS 6ALS	6CB6 (short 2 and 7)	6S4, 9-pin 6AC7, octal	6T4 6T8 6U4 6U8 6V3 6V6 6W4 6W6	6Y6, 6W6 6AX4, 6U4		6S8 octal; 7X7 locta 6V3 9-pin (top cap) 7C5 loctal; 6AQ5 7-p
6AG7 6AH4 6AH6 6AJ4 6AK5 6BC5 6AL5	6CB6 (short 2 and 7)	6S4, 9-pin 6AC7, octal	6T8 6U4 6U8 6V3 6V6 6W4 6W6	6Y6, 6W6 6AX4, 6U4		6V3 9-pin (top cap) 7C5 loctal; 6AQ5 7-pi
6AH4 6AH6 6AJ4 6AK5 6BC5 6AL5		6S4, 9-pin 6AC7, octal	6U4 6U8 6V3 6V6 6W4 6W6	6Y6, 6W6 6AX4, 6U4		6V3 9-pin (top cap) 7C5 loctal; 6AQ5 7-pi
6AH6 6AJ4 6AK5 6BC5 6AL5		6AC7, octal	6U8 6V3 6V6 6W4 6W6	6Y6, 6W6 6AX4, 6U4		7C5 loctal; 6AQ5 7-pi
6AK5 6BC5 6AL5			6V3 6V6 6W4 6W6	6AX4, 6U4		
6AL5		6H6, octal	6V6 6W4 6W6	6AX4, 6U4		
	6ARS (short 1 and 7)	6H6, octal	6W6	6AX4, 6U4		
hAIVI4	6ARS (short 1 and 7)					AAO 2-Ditt (rob cab)
6AN4	6AR5 (short 1 and 7)			6V6		
6AQ5	ONTREO (STROTE T GILOT I)	6V6, octal	6X4			7Y4 loctal
6AO6 6AV6		ovo, octai	6X8 6Y6	6376 63 6		
6ARS 6AQS		6K6, octal	7 A 5	6V6, 6L6		
6AS7			7 A 6			6H6 octal
6AT6 6AV6, 6AQ6		7C6, 7B6, loctal	7A7			6SK7 octal
6AU5 6AV5 6AU6 6	CD0 (:-41 0 7)		7AD7			6AG7 octal; 6CL6 9-p
6AV5 6AU5	6CB6 (interchange 2, 7)		7B5			6K6 octal, 6AR5, 7-pi
6AV6 6AT6, 6AQ6			7B6	7C6		6AT6, 6AV6, 7-pin
6AX4 6Ú4		6V3, 9-pin (top cap)	7C5 7C6		7700 (-14 -4 -7)	6V6 octal
6BA6 6BC5 6	6CB6 (interchange 2, 7)	, cap cap,	7F8		7B6 (short 4, 7)	6AT6, 6AV6, 7-pin 12AT7*, 9-pin
6BC5 6AG5, 6AK5			7N7			6SN7 octal, 12AU7*9-1
6BE6 6BD6		6SA7 octal; 7Q7 loctal	7Q7			6BE6, 7-pin, 6SA7 oct
6BF5		6SK7 octal	7X7			6T8 9-pin, 6S8 octa
6BG6 6CD6			7¥4	10.00		6X4 7-pin
6BK7 6BQ7, 6BZ7			12 AT7 12 AU 7	12AZ7		7F8* loctal
6BL7			12AU7	12AX7		6SN7* octal, 7N7* loc
6BN6			12AX7	12AV7		6SL7* octal 6SL7* octal
6BQ6 6BQ7 6BK7, 6BZ7			12AY7			6SN7* octal, 7N7* loc
6BY5			12AZ7	12 AT 7		00111 00141, 1111 100
6BZ7 6BK7, 6BQ7			12BH7			6BL7*, 6SN7* octal
6C4		6J5 octal	12BY7		6CL6* (plate 6,	
6CB6 6	AU6 (interchange 2, 7)	ooo octar	12BZ7		screen 3, 8, sup. 7)	
6CD6 6BG6			25 L 6			
6CL6	12BY7* (plate 7,	6AG7 octal	25Z5	25Z6		
6H6	screen 8, sup. 3, 9)		25Z6	25Z5		
6J5		6AL5, 7-pin	35 L 6			
6J6		6C4, 7-pin	35W4			35Y4 loctal
6K6		7B5, loctal, 6AR5, 7-pin	35Z3	0.757.7		35Z4, 35Z5 octal
6L6		-, -sout, orito, r-pin	35 Z4 35 Z 5	35 Z 5 35 Z 4		35Z3 loctal 35Z3 loctal

*Note: Check whether 6.3 or 12.6 volt heater voltage is used.



An experimental single-tube color TV camera, sich larger than its black-and-white counterpart.

October 11, 1950, the Federal

Emerson Radio & Phonograph Corporation

Part 1: Clarifying the color TV situation with some predictions on what to expect in color receivers.

mmunications Commission apoved the field sequential system Marly known as the CBS system) official color TV standard for nited States. This system had under development for approxi-10 years, and gave a fairly table performance in compariith competitive methods which more or less newly conceived. It n unfortunate choice, however, he the field sequential color syscequired a vertical field rate of er second (as opposed to the and white of 60) and a line rate 160 cycles-per-second (as against ack and white of 15,750) to elimflicker, thereby making this sysincompatible with black and transmission standards. Finally, the NPA terminated all color ctivity on November 20, 1951 in nterest of national defense, the system, as used in aerial TV missions, died a natural death. trictly industrial television use, 38 system is still being employed sed circuit applications.

the meantime, the Radio-Elecs-Television Manufacturers Asion set up a committee to fore an improved compatible color . The more than 200 engineers physicists of this National Tele-

System Committee (NTSC) 91 leading companies in the teleindustry formulated and tested or TV signal which could fit into present 6 mc. channel, and was atible with the black and white mission standards.

NTSC does not own any equipneither transmitters nor receivers, and is not interested in the detailed circuitry of either type of equipment. Its interest in equipment stops at the point where it has been established that the signal specifications can be met with readily available gear. The end goal is a set of signal specifications, proven and practical, that can be presented to the FCC for approval. That this goal has been met has been amply attested to by the fact that numerous organized field tests have been arranged by the NTSC and attended by some 15 different manufacturers with their color receivers. These receivers represent the varied outputs of the different engineers all working from the same signal specifications and all receivers are producing excellent pictures.

The NTSC Signal

Although a detailed treatment of this new color signal will be made in the second article of this series, a simplified treatment is in order.

From a welter of data pertaining to the physiological aspects of color vision and a mass of theoretical data regarding the character of the television signal itself, the following color signal has been formulated. To the present monochrome standards as they now exist an additional color signal specification has been added. The resultant effect is not unlike the conventional lithographic technique of printing in three colors plus black to add the de-

tail. In our case, the present monochrome information carries the shades of black and white including all the fine detail, and the color information is added on a color subcarrier to fill in the large areas of color (Fig. 2).

Tests have shown that the eye cannot perceive fine color detail, hence, there is no need to burden the color circuits with wide-band information. The shaded area on Fig. 2 indicates that this color information in the lower sideband is restricted to a bandwidth of 1.3 mc. Note, too, that the upper sideband cannot extend this far since the limits of the channel restrict this area to approximately 0.4 mc. Although this unsymmetrical distribution of sideband energy is not a desirable situation, it has been possible to design the details of the system in such a manner that it causes no extra trouble.

Because the lower sideband of the color information falls well within the monochrome video channel it was necessary, in the interest of compatibility, that this color data be made invisible on a standard black and white receiver. This was done (within the limitations of the linearity of the system) by setting the color subcarrier at a frequency which is an odd multiple of half the line repetition rate. The actual frequency selected by the NTSC is 3.58 mc. This unique feature of adding narrow-band color information on a special color subcarrier to a

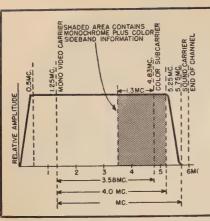


Fig. 2. Color signal characteristics.

standard monochrome transmission is the essential characteristic of the signal. When a color signal is transmitted, the conventional monochrome receiver will present the picture in shades of black, gray, and white with a negligible trace of the picture's color signal origin. An interesting point is that these black and white pictures usually have better resolution than that obtained from conventional monochrome reception. The reason for this improvement is simply that the transmitters have to be more carefully adjusted to handle the color data on the 3.58 mc. subcarrier and, as a result, the monochrome information is present in more detail.

The conversion of a good monochrome transmitter from black and white to color is simplicity itself. (See Fig. 3.) If a color video signal is already available, either from a color camera or a network link, no changes are required. To get this video information from a network a minor investment in new terminal equipment will be required. Networks will probably be the main source of nationwide color transmissions until a sufficient number of color studios are constructed.

The color studio gear and the camera equipment are somewhat more complicated than their monochrome counterparts. Present color cameras consist of three pickup tubes mounted side by side with each one masked with a proper primary filter. By the use of properly positioned dichroic mirrors (mirrors which reflect light of one color and pass all other colors) the single viewed image of one lens is made to fall on each of the three photosensitive camera surfaces. Since these images must pass through green, red, and blue filters respectively before they strike these surfaces, the three resultant video outputs represent the green, red, and blue signals corresponding to these colors in the original scene.

Progress has already been made toward the development of a *single* camera pickup tube that will put out *three* primary signals (Fig. 1). There is no doubt that technical advances in studio equipment will be made towards simplification. In this connection it is interesting to note that the

compatible nature of the signal allo for testing transmitting and receivil equipment by radiating color signification (with FCC approval) without pube announcements of the fact. One of the first such "sneak" transmissions to place late in June in New York C on WNBT during a "Howdy Door) program.

The Color Receiver

The color receiver is basically monochrome receiver with addition circuitry. This additional circuifalls into two groups. The first gro is that part required by the color formation alone. In Fig. 4 this at is covered by the chroma, decodicolor sync, and matrix networks. T part produces as its end product t green, red, and blue video signals. 1. second group is that area of circuin dictated by the requirements of picture tube (or display device). Sin Fig. 4 indicates an RCA tri-color tu a dynamic convergence network used, as required by this tube.

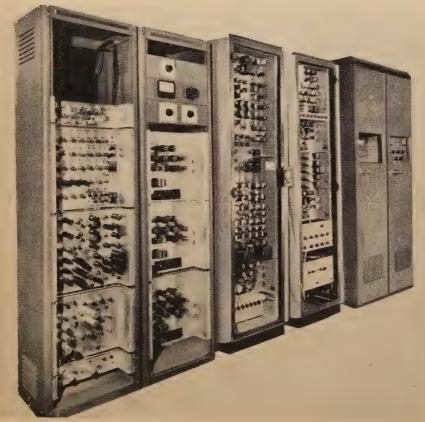
Although the interior of the coreceiver is somewhat more compthan its monochrome brother, user's controls are only complicately the addition of one more knob. To control is marked "Chroma." It allows a customer who takes issue with mathematically correct ratio of control to monochrome to vary this ratio. It picture color can thus be varied from a light pastel shading to an interior of control to the color can thus be varied from a light pastel shading to an interior of the color can thus be varied from a light pastel shading to an interior of the color of the control to the color of the correct ratio of the cor

With regard to the fine tuning ctrol, the public will have to be educated. It will be recalled the split-sound receivers of five years are quired a careful setting of the fruning control or there was no sour This careful setting of the tuner oscillator made for optimum picture quity. However, the problem of oscillator drift gave way to the use intercarrier systems with the net sult that sound was always present that sound

In order that the color receiver tain the benefits of intercarrier oper tion and yet force the customer adjust the tuner oscillator to proper place to insure good coquality, the designer is forced to some sort of tuning indicator. In a case what could be better than a face of the picture tube? The sout traps in the receiver are made she and deep so that when the oscillation properly tuned the picture is clew then the oscillator is mistuned in picture will show annoying sound pleterns.

The most publicized aspect of foolor TV receiver has been the sture tube. All color tubes preserved or being developed have the color phosphors deposited on the frace of the picture tube in either a pattern array or a striped pattern horizontal or vertical. The RCA! color tube¹, utilizing three gun strutures is typical of the former typical the Lawrence tube² as made

Color TV signal generating equipment used by Emerson for the design and testing of color TV receivers. Included is a monoscope and flying-spot scanner.



ic Laboratories, containing a in, is typical of the latter.

ICA picture tube contains a ic dot pattern consisting of dots in each of three colors tal of 585,000 dots. The three so arranged that each gun lite only its particular phostor. As a consequence it is and desirable to excite the ans simultaneously with their We color signals and thereby simultaneous light output in en, and blue. This design does uire any form of sequential ritching and provides a maxiht output roughly three times ich would be available on anv al system using this tube. The inree guns carries with it some mechanical and electronic ciruirements. The first is the tion that each gun strike its we phosphor without contamifrom the other two. The seche problem of registration of be colored pictures. Improvethe production control of the dtube and in the electronic cirossociated with the tube have both problems to an accept-

wawrence tube contains a series green, and blue stripes apitely 0.015 inch wide with a switching grid to allow the rlectron beam to scan any one epending on the switching pospresent. Because of the single astruction, a sequential display tial. This means that this tube suffer from any registration s. However, it does suffer from output loss of two-thirds beunly one phosphor is in use at There is the additional reent of substantial switching to the switching electrodes.

test receivers used by the variinufacturers during NTSC field cave utilized the RCA tri-color exclusively. Although limited or of the Lawrence tube have eleased to the industry, a comse appraisal is not possible at ie. It is probable that the first mion color receivers will confie RCA tube.

lould be quite obvious by now e color receiver will be somenore complex and considerably expensive than the present urome receiver. The picture lone is expected to cost from 1200 dollars. The tube complef the receiver will fall between 50 tubes. These two factors make a cost estimate of the plor receivers fall in the \$750 00 class. In addition, these rewill produce a small picture, by present-day standards. The uccessful RCA tri-color tube deto date contains an exterior imilar to the old 16AP4 and es a 12½" pumpkin-type pic-Although intensive developwork is now going on toward picture there is no indication

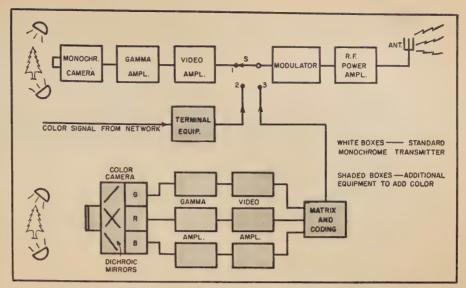


Fig. 3. Simplified block diagram of a typical color television transmitter.

when this larger tube will be available or how much it will cost.

Receiver Production

Obviously there will be no rush to buy the first color receivers. Very few prospective customers will buy a 12½" color picture at \$800 in preference to a 21" monochrome picture at \$300. However, the novelty is expected to appeal to some, and first production schedules will cater to this rather meager demand.

How soon manufacturers will put color receivers in the field, after FCC approval, is entirely up to the manufacturer himself. There will probably not be a repeat of the 630TS experience where RCA released complete data on this black and white receiver to their licensees, covering chassis layout, component specifications, alignment procedure, troubleshooting, etc. It will be necessary for each manufacturer to build up a nucleus of engineers familiar with the color TV problem. Fortunately, a number of

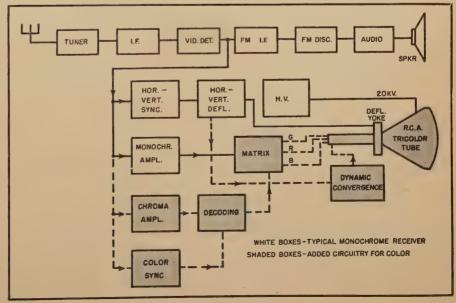
companies have already done this and have also accumulated a fair amount of specialized test and alignment equipment.

The next step, however, is actual The single bottleneck production. here is the test and alignment equipment for line use. Delivery of this material, from only a few sources, is quoted at from six months to a year. Realizing this, some manufacturers have already placed orders for production test equipment prior to FCC approval. Assuming FCC approval early in 1954, it is safe to say that the first color receiver will be released in the late spring of 1954 with a number of manufacturers in the field by the fall.

The Service Technician

The conscientious service technician who understands the workings of a black and white receiver will not fear the complexities of a color receiver. The transition is not as dramatic as (Continued on page 173)

Fig. 4. Simplified block diagram of a typical color television receiver.



LOUDNESS CONTROL By Michael H. ESTKOWSKI

OUDNESS controls, as opposed to volume controls, have come to mean frequency-compensated, sound-power level controls. This article describes such a control. The various shortcomings of controls available on the market or through technical literature are circumvented in the author's version. Although loudness controls are a controversial topic, several publications have appeared which treat the problem in a rational and experimental manner (See References). For the reader's convenience, the salient factors affecting frequency compensation at various loudness levels are reviewed briefly.

The reference for all tonal compensation of volume controls is the Fletcher-Munson curves, shown in Fig. 1. These curves represent contours of equal hearing loudness at different frequencies over the audio spectrum at various sound-power levels. The upper and lower extremes of these contours are the sense of feel at and above 100 decibels, and the threshold of hearing at 0 decibels. For example, the 40 db curve represents the soundpower necessary at the different frequencies so the hearing loudness will be of equal intensity. Immediately we see that a flat frequency control will not do a satisfactory job at soundpower levels below the originally produced loudness. Unless our nerves are of non-resonant steel, we will not listen to music at its concert hall or dance hall loudness in our 15 foot by 20 foot living rooms.

At first glance we nurse the idea that we can use the bass boost tone control to handle the problem. However, if we want music at about a 50 db level (moderately loud), then from the Fletcher-Munson curves we notice that the volume setting for 25 cps is 35 db above the setting for 1000 cps (the reference frequency of these curves). So, if we look again, we realize that tone controls providing these characteristics are hard to get. If we go to a level of 40 db, the difference between the 25 and 1000 cps settings is about 42 db (40 db level is soft background music-the kind we like with our meals). What average tone control can do this!

A tone-compensated volume control which is relatively sist to build and follows the Fletcher-Munson curves very clo!

Besides these points, there is one more problem to contend with. It is the fact that in using amplifiers for reproducing purposes, the 100 db full-power reference level (threshold of feeling) may be excessively loud. So, it becomes necessary to lower the level of full-power to some appropriate value. As cited in Reference 1, this level is averaged at about the 80 db contour curve. In this case, the necessary compensation is about 14 or 15 db higher than the values given previously.

Nothing has been said about the high frequency end, i.e., frequencies above 1000 cps. The controversy on this point is complicated. However, the Fletcher-Munson curves do show some boost from 5000 cps on up above the 10,000 cps level. This boost exists at all levels of sound, though. The author contends that there is a need for some high-frequency boost above 5000 cps. It is especially true with amplifiers drooping at the high end and rooms where the noise level is above average. Furthermore, people with natural hearing impairments need extra compensation on the high-frequency end.

The author's control was designed to meet these requirements. Circuitwise, the components are non-critical and the network is very simple, Fig. 2A. The volume level does not go all the way to zero, but this is not a fault since at a minimum setting the sound level is at or very close to the threshold of hearing (it can be made to fall in this range). In cases where the listener wants no sound he usually turns off the amplifier or takes the needle off the record.

Electronic operation of the control is based on two sections of RC low-frequency crossover circuits. There are three components in each branch, R_1 , R_2 , C_1 and R_3 , R_4 , C_2 . Values of R_2 - C_1 and R_4 - C_2 determine the crossover frequency and may therefore be

selected to produce the desired acteristic. The function of R_2 at is the flattening of frequency respectively beyond the crossover point. Call tions for achieving the desired reare very simple and an example trates the method of procedure.

Assume a value of R_1 to be 1 ohm (a volume control in this and further ascribe the condi that at a minimum setting of A bass frequency of 20 cps is to b tenuated 6 db-a voltage ratio o proximately 2. To attain this i it is necessary that $X_{c_1} + R_2$ at 2 equal 1 megohm. Furthermon crossover frequency of, say, 1506 is required. This is done by sele the value of C_1 to have an imper of 1 megohm at 20 cps and temp ily ignoring R2. Using a reace chart or the Shure slide rule, C1 i μfd. The next step is to find th actance of C_1 at the crossover quency, or 1500 cps. With the value of C_1 the reactance at the sired frequency is 13,300 ohms this stage the value of R2 may b termined. If R2 is 13,300 ohms it w seem that the crossover would f. about 1500 cps and the attenur remain flat from there on in. In tice, however, such is not the The crossover falls about an o higher than the assumed frequency by using this method of calcul-So, if a resulting crossover frequency of 1500 cps is desired then the e lations should be based on about cps. Revising the computation find that X_{c_1} at 800 cps is 25,000 μ in rough figures. R_2 is made 1ohms. With these conditions th tenuation of 1500 cps at a mini setting of R_1 is:

(25,000 + 13,300)/(1,000,000 + 000 + 13,300) = 1/36.9 or about

This method does not produsharp crossover, but it nevertly approaches the ideal asymptotic

sy as simple RC networks can. important part is the fact that ufference in attenuation between s and 1500 cps is 25.4 db. Fursiore, an RC network can only maximum attenuation curve of per-octave, and the requirements considerably more than that. fore, by cascading another simivection (in this case R_3 , C_2 , and he attenuation at a minimum ng of both R_1 and R_3 becomes 50.8 he potentiometers are ganged). boost the high frequency output ttings other than maximum a onser shown as C_3 in Fig. 2B may nnected between the tops of R₃ \Re_{5} . The effectiveness of C_{3} is counted by C_2 and therefore R_0 , Fig. about 10,000 ohms may be in-II. It is to be noted that the deibf high-frequency boost may be polled at will by appropriate val- ${}_{\!\!\!6}$ ${}^{}$ ${}^{}$ ${}^{}$ ${}^{}$ and ${}^{}$ ${}^{}$ providing ${}^{}$ ${}^{}$ does not the too large compared to R_5 . This 🕯 fact will introduce an insertion since the total frequency specis developed across R_5 and R_6 , the output is taken across R_{5}

ponse curves of the loudness ol of Fig. 2A, are shown in Fig. Inparing these with the Fletcheron curves, Fig. 1, we note that high they do not coincide, the aph is close and considerably betan the curves published to date. tening tests proved that the concoes a very good job. Some listenemoaned the lack of high-freby notes. After inserting C_3 of fd. and R_6 of 0 ohms even these ial individuals were satisfied.

Insference of the maximum referlevel, mentioned previously, may Itilled by having a non-compenvolume control ahead of the ol in question. As a matter of the compensated control acts as ry effective bass tone control s used with a straight attenuator of it.

le home experimenter will be antly surprised when the control t through its paces. However, building the control care must ken to keep the component parts from electrostatic fields. The ct has fairly high impedances and ances which are prone to pick .m. To alleviate this situation R_1 R_8 can be 500,000 ohms each. to preserve the attenuation acteristics, C_1 , C_2 , R_2 , and R_4 have changed in accordance with the lations given. The value of R_5 o be high enough to prevent a

sides operating as a non-linear fuator of frequencies below the over point, the loudness control perate as a low-frequency boostit is the R_0 of a preceding vactube stage. That is, if the loudcontrol has a shunting effect on late load of a vacuum tube amation stage feeding into it, then shunting effect decreases with frequencies and causes a higher

ging effect on R_3 , C_2 , and R_4 .

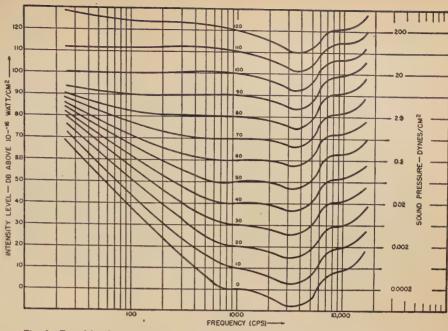


Fig. 1. Equal loudness contours for normal ears, known as the Fletcher-Munson curves.

output signal voltage-as compared to the output at frequencies above the crossover point. In this fashion the control has two simultaneous functions: (1) it acts as a bass boosting complex plate load for a vacuum tube (cancelling the effect of coupling condensers) and (2) it attenuates frequencies in a manner which results in the Fletcher-Munson hearing characteristic curves.

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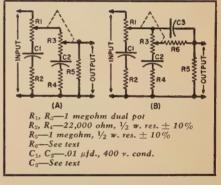
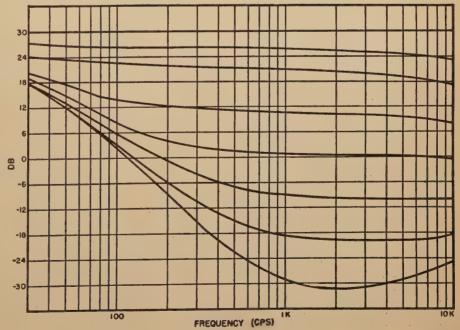
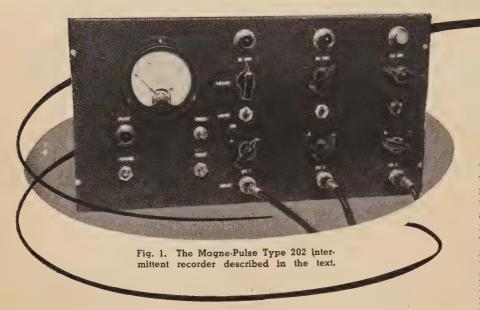


Fig. 2. (A) Basic circuit which produces the frequency response shown in Fig. 3. (B) Addition of C₃ and R₆ makes it possible to increase the output of the high frequencies.

Fig. 3. Response curves of the loudness control circuit shown in Fig. 2A. When pots \mathbf{R}_1 and \mathbf{R}_3 are set for maximum output, then the frequency response is flat at 30 db across the entire audio spectrum. See text for further discussion of this point.



NEW TV INTERMITTENT CHECKER



This new TV service instrument may help eliminate one of the most difficult TV service problems: intermittents.

NE of the most troublesome and time-consuming service faults that the average technician encounters is an intermittent, that is, a trouble that occurs only for a short period of time and then disappears for a much longer time. Not only does such a trouble try the service technician's patience, but equally important, it is often the cause of customer dissatisfaction and many callbacks. Although only about 10% of the sets brought into the shop are intermittents, they often take from 30 to 40% of the technician's time.

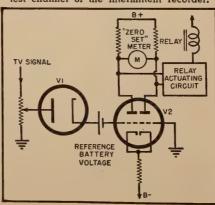
A new instrument designed to detect intermittents and localize them to the specific circuits and components in which they occur is shown in Fig. 1. This intermittent recorder is connected to three key points in the intermittent radio or TV set, and the set is turned on. The service technician can then continue to service other sets. When the trouble occurs in the intermittent receiver, the recorder immediately detects it, a buzzer is sounded, and a lamp lights, indicating to the service technician exactly where the intermittent has occurred or is occurring. An important feature of this instrument is that this lamp remains on even if the trouble disappears. Thus, even if the service technician leaves the shop, he will know that an intermittent occurred, and in what circuit.

The intermittent recorder is extremely flexible in that it can monitor any three circuits in the set and can be used to localize the trouble to incividual components. If the service

technician has no idea where the intermittent is occurring, the three lines can be used, for example, to check the video output, audio output, and high-voltage drive. Assume that the intermittent occurred in the video circuit. The video line lamp lights up. Now the three lines can be placed on three different stages in the video section. The next time the intermittent occurs, the trouble will be localized in a specific stage. Finally, the three lines can be placed at three points within the stage; for example, the grid, cathode, and plate circuit. This enables localization to several components.

The basic circuit of one channel of the intermittent recorder is shown in Fig. 2. V_1 rectifies the input signal from a stage in the TV set. V_2 is a dual-triode used in a balanced circuit. The grid of the first half is biased by

Fig. 2. Simplified basic circuit of one test channel of the intermittent recorder.



JOSEPH RACKER Magne-Pulse Corporation

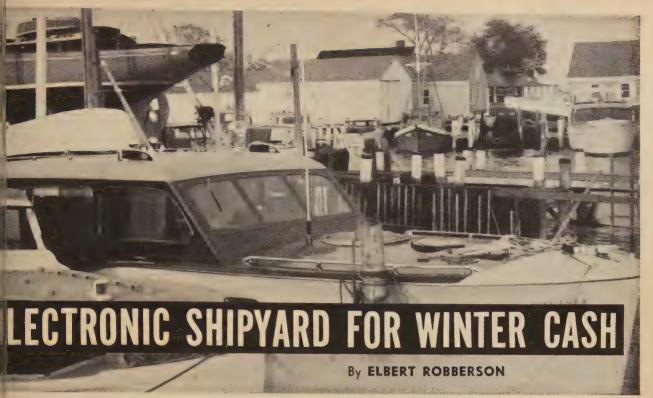
the TV signal and the bucking 1 tery reference voltage. With the receiver operating normally, the tentiometer in the rectifier circuit adjusted so that the rectified TV nal voltage exactly equals the batts voltage. This effectively places \circ grid of the first half of V_2 at zero: tential and balances the circuit. practice, this is simply done by adjuing the front panel potentiometer responding to the line used for

"zero" meter reading.

When an intermittent occurs, TV voltage varies sufficiently to balance V_2 , which results in a volve being applied to the relay actual circuit. Actuation of the relay can the buzzer to sound, turns on lamp, and "locks out" all other m tor circuits. That is, only the channel in which the intermittent curred will become unbalanced. I other circuits which are affected the intermittent milliseconds later not cause their lamps to light up. example, if three video stages are ing monitored, an intermittent sl ing condenser in the first stage eventually affect voltages in the ond and third stages. However, the circuit monitoring the first s will become unbalanced, since the termittent is occurring in that st The instant that this circuit bece unbalanced, it locks out the stages. Thus, only the lamp of test channel monitoring the first vi stage will light up. The test char-in the intermittent recorder per acceptance of positive or negative and a.c. voltages and cover var ranges of sensitivity.

Some typical servicing experien with the intermittent recorder give some indication of how it ca used. In one case, the customer plained that the picture on his T intermittently became narrow, margins would be seen on both and right. This happened after set (a Motorola 16K2) was turne for about one hour. Obviously horizontal drive voltage was dec The intermittent recorder therefore, connected directly to circuits in the horizontal drive. most sensitive test line was conn to the grid of the horizontal o tube, which checked all circuits

(Continued on page 196)



The time to start rehabilitation and repair of the electronic gear is when the boats come into the yard for winter storage.

FIRST winter in the marinetio business was cold! But in spring the way to pay the offcrent became obvious: operate retronic shipyard!" When the the hauls a boat, you haul the tic gear in for a winter checkth safe warm storage.

been called to service a linepats that had just been dunked, wowners were breathing down k. In each case, after checking ternal connections of the radione, and opening the cabinet to swoltmeter on the "B-plus," I reped the "on" switch—and got! In a couple of cases there "voltage, but also a wisp of

boatmen had economized by everything aboard through ter. Anyone who has climbed a boat early some wintery g has seen condensed water ng on all the metal in the It happens inside equipment as outside, so after a few months er plates grow a beard, conorrode, and insulators turn into de resistors. I resolved that inter, every piece of gear pospuld come into the shop. After d out an assembly-line process rned into a profitable procedich can well be used by anythe game.

importance of proper winter in doubt, here are some statis-ake three groups: (1) equipted aboard all winter; (2) equiptemoved by the owner or shiptechanics; and (3) equipment all, stored, and reconditioned by he-radio technician.

Stagger your work load and stabilize your income by setting up a plan for handling your marine service work "off season".

In 90% of the vessels in case (1), when I was called to fire up the equipment in the spring, it had to be marked "Dead on Arrival." The 10% that worked were in boats that kept heat up, either by warm inside storage or other arrangements. The main causes of failure ranged from sticking vibrators to grass growing in the condensers, but a thorough shop check was indicated in every case, even though a little work on the spot might induce the set to show life. For instance, a stuck vibrator might be shock treated, by a stiff belt with the handle of a screwdriver, and the "Bplus" would come up—then it would drop and all that would be needed for smoke signaling would be an Indian blanket.

The boats in category (2) averaged about 50-50. The troubles were slightly different, but troubles there would be. After the vibrator was induced to buzz, the set might work, but not very well. Trouble ranged from the receiver being dead, because the owner had noticed a bunch of loose screws which he had of course tightened (the i.f. and front-end tuning adjustments, naturally); short-circuited transmitter-coil turns, dropping output to zero or just slightly more; to the bitter extreme of a reversed battery hookup causing electrolytic destruction of metal fittings and engine parts below the water line.

I went aboard one such boat on a

service call and found it sinking. A hurry-up call to the shipyard got the vessel hauled out just a little before the time when fish would have been swimming in and out of the portholes. Inspection showed the propeller shaft to be dissolved to the size of a pencil, the propeller a delicate bit of bronze lace, and some fittings were completely absent. To save money, the owner had connected up his own radiotelephone-backwards! Full battery voltage was put between the engine fittings and the ground plate, and the seagoing demon, electrolysis, sat down to the table for a full meal.

Failures on boats in group (3) were almost nil. Whenever trouble showed it was from causes external to the equipment, such as dead batteries, or short-circuited antenna insulators—all things easily corrected at the time of equipment re-installation.

There is just one big question mark, and that is: how can money be made on winter-storage service? Without an efficient system, time is wasted in travel and set-up for service, and the cost may be out of proportion to the job

Preparation is required, both in the "administrative" department and in the shop. Toward fall, send a letter to every prospect offering the service. Customers like to know what they are getting into, so outline your rates. Labor may be charged for by the hour,

(Continued on page 189)

SKIATRON'S "SUBSCRIBER-VISION"



Utilizing a program card which carries a printed circuit to complete connection, this system is now being demonstrated.

NEW electronic system for the transmission of scrambled video and sound signals from a TV station and their unscrambling at the home of subscribers was demonstrated to a New York audience recently by Skiatron Electronics & Television Corn.

Basically, the "Subscriber-Vision" system of TV transmission and reception is not too complex. The picture as well as the sound signal is transmitted by a regular television station on its assigned channel. The station, however, must be equipped with an "S-V" coder unit. The coder scrambles the picture and sound signals in any desired random or regular manner. If this signal is picked up by any set not equipped with a decoder, the sound is completely unintelligible and the image on the screen is a multiple one.

At the receiving end, the set ownersubscriber has a small decoding unit which can be easily connected to any TV receiver. The decoder may be either a small box-like unit, as shown in Fig. 1, or the decoder circuit may be built into the receiver itself at the time of manufacture. The function of this decoder unit is exactly the opposite of that of the coder unit at the transmitter. It takes the scrambled picture and sound and unscrambles it.

The Decoder

The decoder operates in the follow-

ing manner. As can be seen from Fig. 1, a card is inserted into a slot in the decoder. This card looks very much like an IBM card and carries the codes that are used for the programs covered by the card. The programs for the week are listed on top of the card and the codes corresponding to these programs are contained in printed circuits on the lower part of the card. The card used at the demonstration listed seven programs, one for each day of the week. The subscriber selects his program on the card and when that program is about to start he depresses the corresponding pushbutton on the decoder unit. push-button actuates a switch which connects the proper circuits in the decoder and the picture is unscrambled. As soon as any push-button is depressed, a small hole is punched into the subscription card so that there is proof that a certain program has been seen and should be billed.

Coding of the Signal

The transmitter and receiver block diagrams are shown in Figs. 2 and 5 with the additional equipment required for the "Subscriber-Vision" system shown within the dotted boxes.

In transmission, the picture is shifted several times in the horizontal direction. Thus, the video signal of several fields is shifted with respect to the horizontal sync pulses in such a manner that there is quite a notice-

By RUDOLF F. GRAF

able phase shift between fields. In way a series of pictures is transmireach of which is complete in it but jiggles back and forth in a horistal direction. This multiple transmission can consist of two or three as many as five, six, or seven imare Furthermore, the fields do not not sarily have to appear in sequely for example, let's assume the edeals with four pictures and see at this process is handled.

These four pictures could be sent in the order: 1, 2, 3, 4, 1, 2, 3, 4, or could be transmitted as 4, 3, 2, 1, 12, 1, or 4, 2, 3, 1, 4, 2, 3, 1, or 4, 1, 3, 1, 3, 2, or any of the other post combinations. If we choose and these or another similar code and peat that sequence continuously, have a code which varies at a regrate. If the sequence varies in any predictable manner, we have a "dom" code.

It can be seen that there is a mendous number of possible comptions of horizontal displacements, only problem left is to select a which can be represented on the scriber's card and yet be reason secret and tamper-proof. This cac accomplished quite easily as windiscussed.

The Transmitter

Three blocks in Fig. 2 make up heart of the video coding unit. I are the "Field Selector," the "Swing and Coding Circuit," and "Soft Generators #1, #2, #3." In ordination of this tem, we have chosen a code which a maximum variation of three, the picture will be in any of positions at all times.

First let us consider the type code used and then we will see he is produced by these circuits. Present system works with a code is basic with each card. That not that as soon as the card is insertited decoder, some of its twenty contacts establish a basic code. Code is shown as the "Code for Week" at the top of Fig. 4. Note the code is incomplete by itself (third space is blank) and mustilled in.

Even though the "Code for Week" may be quite involved "filling in" may be accomplished very simple sequence such as 2, 1, 2, 1, or 3, 1, 3, 1, 3, 1 or 3, 2, 3, 2, etc. or any other sequence for course, to the relative tion of each field at any one partitime. If we study the sample for a minute, we see that the pi

do quite a bit of moving along screen of the tube. Although it look like a jumbled mess, there till a fixed sequence that is foled.

he input and output signals of the reep Generators" are shown in Fig. Into the circuit come horizontal c pulses which hold the whole ig in phase. Coming out of these uits are three horizontal sweep hals of exactly the same frequency, each slightly displaced from the er. The three signals are designed as A, B, and C.

the "Field Selector" feeds rectangar pulses into the "Switching and ling Circuit." These pulses take up time of a complete field. Now, in er to put everything together, we to refer back to Fig. 4 again. We work with the code for program which has a sequence 1, 3, 3, 2, 3,

!, 2, 3, 1, 1, 1, 2, 3, etc.

"he pulses shown at "A" are vertical c pulses. They appear at a field Thus the space between them is field. In order to understand the tem more easily, the spaces been each of these pulses have been ed in with the code numbers of pro-m "Y." Therefore, the code sence is actually the field sequence. we now realize that the output tages from "Sweep Generators #1, and #3, are used for fields 1, 2, 1 3 respectively, we have the puzalmost solved. All that remains v is to select these pulses at the ht time for the duration of one d. This job is done by the "Switch-Circuit." This circuit receives the are waves produced by the "Field ector" at a rate corresponding to particular code used. These square wes are shown in Fig. 4 as "B," "C," "I "D." The separate sweep volts they produce are shown as "E,"
" and "G" and their combined outt as "H." Remember that we are e discussing fields and their inwidual lines. What is actually moved the video signal. The horizontal nc pulses are not disturbed but the ase of the video signal between m is changed every field or so.

As far as the sound signal is concerned, the coding process is a little is involved. The audio signal is first involved. The audio signal is first inplitude modulated at a relatively requency in "Modulator #1." is modulated signal then goes to a sequency remodulator where it is rambled at the same rate as the pictre. This scrambled signal then goes prough a bandpass filter into a concernated as "Modulator #2." Then it transmitted as a scrambled fremency-modulated signal.

No decoding pulses are transmitted. The decoding is done entirely at the ower's home by using the proper rd and depressing the correct but-

on the decoder.

The Receiver

The block diagram of the "Subriber-Vision" adapted TV receiver is

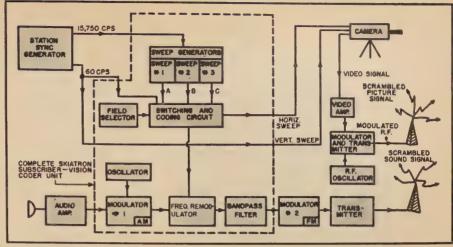


Fig. 2. Block diagram of transmitter adapted to handle S-V coded transmissions.

shown in Fig. 5. Since the problem here is to unscramble a scrambled picture, the circuits used must do essentially the opposite of what is done at the transmitter. Again the vertical and horizontal sync signals are utilized as at the transmitter. They are fed to a "Field Selector" and to "Sweep Generators #1, #2, and #3."

As before, the "Field Selector" feeds rectangular pulses to the "Decoder Unit." These pulses again cover one or more fields depending on the code, The output signals from the three "Sweep Generators" are out-of-phase with each other by exactly the same amount as those at the transmitter. The sequence in which these three signals A, B, and C are used, is determined by the push-button depressed. The bottom part of the program card contains twenty-nine electrically conductive areas which are interconnected in a manner determined by the code used during that (Continued on page 191)

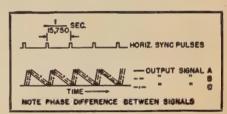


Fig. 3. Output signals of sweep generators #1, #2, #3 of S-V transmission system.

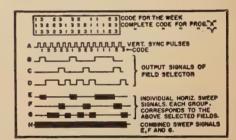
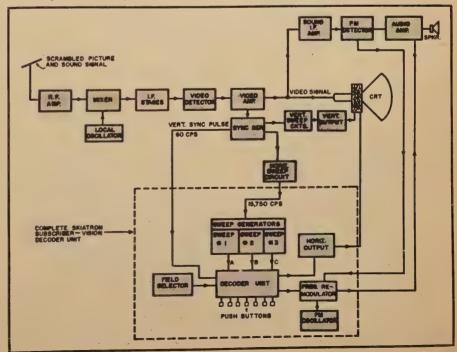


Fig. 4. Signals at field selector and coding and switching circuit of Figs. 2 and 5. See text for details on these patterns.

Fig. 5. Block diagram of the S-V decoder installed in a standard television set.





A pioneering amateur development in the transistor field, the "Transdipper" is a "grid-dip" meter in its most modern form. Completely self-contained, its range is 1.7-33 mc.

THE difficulties connected with the use of a grid-dip oscillator in adjusting the elements of a parasitic array-dragging a long extension cord and the oscillator with its associated power supply up a steel tower, supporting yourself and the instruments at the top of the tower, and trying to take readings and adjust the elements at the same time-make it plain that a portable, self-powered GDO would be a very handy gadget to have. Such an instrument would find many uses. not only outdoors but in the "shack".

The necessary features for such a gadget include (1) portability, (2) self-contained power supply, (3) compactness, and (4) one-hand operation. In the "Transdipper", which is shown in the over-all photograph, all these features were made practicable through the use of the newest member of the electronic-devices family-

The use of an RCA 2N33 transistor affords great opportunities for miniaturization and simplicity because this tiny device utilizes no "heater" power, requires no warm-up, and uses little power. The transistor also provides greater stability of operation during handling of the instrument because it is shock-resistant. The "Transdipper" is capable of being held and operated with one hand, and is powered with a small hearing-aid battery. Operating at about 25 milliwatts, it is instant-starting, is extremely stable, and compares favorably for sensitivity with its bigger brothers employing electron tubes.

Design Considerations

The first problem in building a transistor GDO was finding a suitable oscillator circuit of the variable-frequency type. Information on highfrequency transistor oscillators was rather scarce at this stage, but, some basic oscillator circuits were located1 and the first unit was built breadboard fashion. With the aid of a heterodyne frequency meter and a crystal probe, a variable-frequency oscillator was finally constructed which was reasonably stable.

The next problem, the toughest one of all, was to locate a point or points in the oscillator circuit at which a maximum change in current or voltage occurred when the tank circuit of the oscillator was loaded. Because the input to the oscillator was on the order of 25 milliwatts, it was necessary to use low-range instruments for this search. The idea of using a d.c. instrument as an indicating device was quickly abandoned changes in direct current readings were never greater, at best, than about 10 per-cent. Because a search for changes in r.f. current or voltage might prove more successful, a crystal probe coupled to a 0-50 µa, d.c. micro-

RCA Tube Department Harrison, N. J.

ammeter was used to probe the circuit for r.f. voltage points which would give the desired indication. Although good readings were obtained at various points in the circuit, the changes in r.f. voltage, although much greater than the direct-current changes, were still not entirely satisfactory. At this point it appeared that further improvement in the oscillator circuit itself was in order.

After considerable experimentation it was discovered that the "Q" of the tank circuit played an important part as far as sensitivity and maximum r.f. voltage change were concerned. The "Q" of the circuit was improved by connecting the transistor base, originally connected at one end to the tank circuit and at the other end to "B+" through a bypassed resistor, to the center tap of the tank coil. An improvement in dip resulted from this change.

Further experimentation with the breadboard model involved circuit modifications which resulted in increasing the output from the oscillator, improving the "Q" of the experimental coils, locating a point in the circuit which gave the maximum dip, and eliminating serious false dips. The circuit shown in Fig. 1 was finally developed. In this circuit, which is basically simple, L_1 and C_3 determine the frequency of oscillation. The indicating circuit, a conventional crystal probe with a microammeter in the output, is connected across the tuned tank circuit and indicates r.f. voltage. When the tank circuit is loaded the r.f. voltage drops giving the desired dip in the meter reading.

Possible Layouts

Because further experimentation might prove interesting, it was decided at first to build the "Transdipper" as shown in the drawing of Fig. 1. This. type of construction has proved quite popular for certain types of instruments. It is ideal for those who wish to experiment further with the circuit, because it allows use of the instrument during periods of experimentation and provides breadboard layout facilitating experimental work. After some thought, however, the plans for this type of construction were abandoned because they did not lend themselves to one-hand operation or proruggedness, shielding, and further naturization.

search for miniature components wed that the indicating instrument ild be the largest component. The tery, tuning condenser, switch, and iable resistors, in that order, are t in size. A number of full-scale wings was made of the parts layand parts were rearranged to vide compactness, ease of opera-, and shortest wiring paths. A -piece metal case was finally seed; upon completion of construcand adjustment, the two pieces snapped or screwed together to vide the proper shielding and proion planned for initially. A $2\frac{1}{4}$ " ¼" x 5" ICA "Flexi-Mount" case found to be quite satisfactory. final arrangement of parts, shown Figs. 3 and 4, is easily recognized he type used in some commercially ilable grid-dip oscillators employan electron tube or tubes.

Construction

ecause a suitable dial for the ansdipper" was not commercially ilable, and because this part was only one lacking before construccould get under way, a homele dial was devised to fit the in-iment. This dial, which was cut h a one-eighth inch sheet of Lucite, trudes from the upper front sides he case for easy manipulation. The is read through a cut-out hole in case. A brass bushing about 34" liameter and 4" thick having a hole and set screw was fastened the Lucite disc by means of two ntersunk machine screws. A piece white drawing paper was cemented he upper surface to complete the

iany of the parts used in the ansdipper" fitted compactly, some trances being as small as 1/32 inch. simpler tuning-condenser mountis desired, it is quite practical to ch the condenser directly to the er side of the case. The dial may be located on the outside of the o, instead of on the inside as shown. is a good idea to solder lengths of e to the terminals before mounting of the components because it may 'e difficult to reach the terminals a a soldering iron after the compots are mounted. The components e mounted in the following order: socket, switch and tuning conser, meter, and the two variable stors. It is wiser to wire the ciras the components are installed n to install the components comely and then attempt to complete wiring, because space is limited. use of a soldering gun for this of construction is quite helpful.

Coil Design

line with the compact design, henol 24-5H forms were used for coils. The completed coils are vn in Fig. 2. The use of small-coils provides for more convenient ss to tight places when measure-

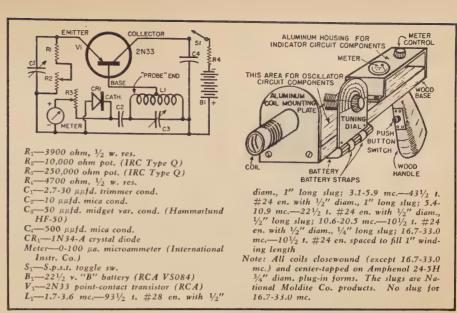


Fig. 1. Complete schematic of the "Transdipper" and an experimental "breadboard" layout which still affords operating convenience. The metering circuit measures changes of r.f. voltage, which is more effective than measuring d.c. current dips.

ments are being made. It is important that coils having a reasonably high "Q" be employed with the instrument to help obtain a good dip. Unfortunately, high-"Q" coils at first caused greater difficulty with false dips. It was observed during experimentation that the coils used for the low-frequency bands (160 and 80 meters) created the chief difficulty with "Q". Powdered-iron slugs were finally provided for four of the five coils to improve the "Q". Holes were drilled and tapped in the bottom of the coil form and each slug was screwed into position with the aid of a lock washer and nut. The top of the slug was lined up approximately with the probe end of the coil. The coil data in Fig. 1 gives the necessary specifications for making the five coils which cover the five low-frequency amateur bands.

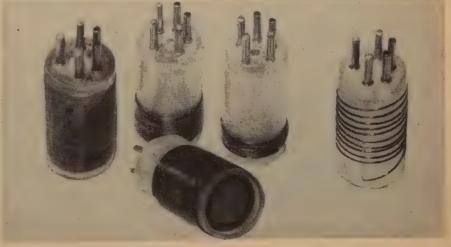
The use of the "Transdipper" can be simplified if the coils are colorcoded to match the colored frequency scales on the dial. Upon completion they should be coated to hold the wire in place. A plastic spray is suitable.

Adjustment

Because some readers may wish to build a "Transdipper" for their own use, the remainder of this article is written in a "how-to-do-it" style. Because transistors are rather costly, it is a good idea to double-check the circuit wiring. It is especially important that the correct polarity be used for the battery connections. Transistors are extremely rugged mechanically, but may be easily damaged electrically.²

Before the case is assembled connect the instrument to a d.c. source which will supply the proper voltage. A low-range d.c. milliammeter may be used during this initial test to measure the total battery current which is approximately 3.5 ma. It is advisable to turn the switch off before inserting one of the coils. Adjust the meter control knob for maximum re-

Fig. 2. The plug-in coils for the "Transdipper." Left to right, coils for 1.7-3.6 mc., 5.4-10.9 mc., 3.1-5.9 mc., 10.6-20.5 mc., 16.7-33.0 mc. The four lowest-frequency coils have slugs to adjust the "Q" of the coils to obtain reliable "dipping" action.



sistance and apply power. The "Transdipper" microammeter should show a reading indicating that the oscillator is functioning. Now, listen for the oscillator signal with a receiver. The beat-frequency oscillator of the receiver should be turned on. (Incidentally, the 2N33 transistor should not be inserted into or withdrawn from the socket with the power on because high transient currents may cause permanent damage to the transistor.) When the signal is located, it should be checked for frequency stability and tone. Tap the instrument. If the circuit has been wired correctly, satisfactory solder connections made, and components rigidly mounted, the frequency should not change more than a few cycles during this test.

The next step is adjustment of condenser C_1 . The emitter resistor R_2 should be set for maximum resistance when this adjustment is made. At the low frequencies a larger value of capacitance is required for C_1 to sustain oscillation than at the high frequencies. To eliminate continual adjustment of this screwdriver control, therefore, it is recommended that the minimum value of capacitance required to sustain oscillation at the lowest frequency be used. This minimum value of capacitance is also suitable for the high frequencies, although better output and dip are obtained when this condenser is adjusted for maximum output on any tuning range. The adjustment of C_1 may be eliminated by the installation of a small fixed condenser in the base of each coil connected to the two unused pins on the coil form. Wire the coil socket accordingly. Select the optimum value of capacitance for each coil range.

Grasp the probe end of the coil and observe the meter reading. If the instrument is operating properly there should be a noticeable dip in current. The case may now be assembled and all coils checked for operation, proper frequency range, and overlap.

Calibration

Because the primary function of a grid-dip oscillator is to determine, conveniently and quickly, the approximate resonant frequency of a tuned circuit, the accuracy of the tuning dial is generally not considered too important. Therefore, the station receiver may be utilized satisfactorily for calibration of the dial.

Calibration of the dial is accomplished by providing a suitable reference line above the dial and, starting with the lowest frequency coil, simply placing a dot on the paper scale below the reference line with a pencil and marking in the frequency. To provide for easy reading of the dial, use the innermost arc for the lowest frequency coil and progress outward during the calibration of the other coils.

The dial may now be inked and, if desired, may be coated with a plastic spray for protection.

Operation

To determine the resonant frequency of an unknown circuit, insert a coil which you anticipate will be suitable. Turn the switch on, adjust the emitter resistor for maximum output, and then set the meter needle to about three quarters of full scale

with the meter control potentiometer. Couple the coil of the "Transdipper" tightly with the circuit under test and swing the tuning dial slowly over its range. A large dip will occur at resonance. The tight coupling, however, will throw the dial calibration off slightly; the instrument should be backed away, therefore, until only a small dip is observed.

If difficulty is experienced with false dips, readjustment of the emitter condenser or the emitter resistor will help. Locate the largest false dip and maximize output on that frequency. When reasonably high-"Q" circuits are checked, the real dip at resonance is unmistakable provided tight coupling is used.

Like conventional grid-dip oscillators, the "Transdipper" may be used as a wavemeter, signal generator, and field-strength meter, and for the determination of values of *L* or *C* when one set of values is known.

When the "Transdipper" is used a a wavemeter, leave the switch in the "on" position and gradually approach the source of r.f. The meter will peak sharply at resonance.

Finally, the author wishes to express his appreciation to R. M. Cohere A. L. Cleland, and D. R. Baird of the RCA Tube Department for their valuable suggestions and helpful assistance.

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<u>-30</u>-

Fig. 3. The "Transdipper" is built in half of an ICA "Flexi-Mount" case; other half holds batteries. The positive battery posts are grounded to case by phosphor-bronze springs. Another phosphor-bronze strip contacts the "B-Minus" connection post near the meter. C₃ is mounted on α bracket secured by S₁.

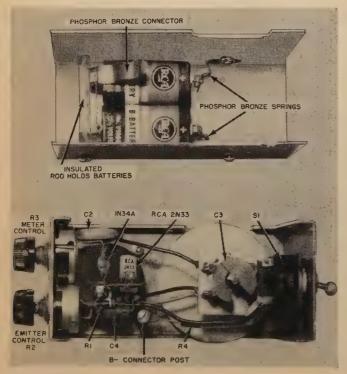
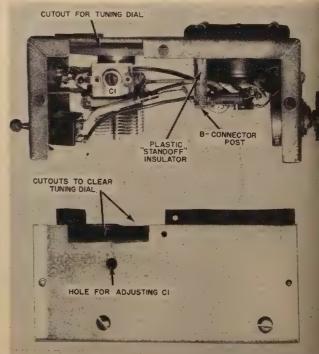


Fig. 4. Side views of the box sections, showing cuts necessary to clear the tuning dial. As the rotor of C_3 is grounded, C_3 may be mounted directly on the side of the box with the dial outside, eliminating cutting. C_1 , the emitter condenser, is visible in this view. Its adjusting hole is on other cover.



NOW YOUR 1954 GENERAL ELECTRIC

Ву

JACK NAJORK

District Service Supervisor
io & TV Dept., General Electric Company

LL 1954 General Electric television receiver models incorporating the feature "Ultravision," use the E" chassis described in this article ill shown in Fig. 1. This chassis, as as the standard "F" chassis, are Inufactured by a relatively new, chanized, dip-solder process. Since iny service technicians are not iniliar with this process and are, irrefore, uncertain as to what refr techniques to use when removing itesting components, a brief descripon of this soldering system follows. Referring to Fig. 2, four basic steps involved. For simplicity, the ss-section of only one joint is own. In actual production, approximately 400 of these joints are odered simultaneously. The joint se consists of a hollow pin secured a textolite board; the board, in n, being riveted to the main chassis ck. These details can be seen from g. 1.

In the first assembly step, comhent leads and wiring are inserted o the pins while the chassis is in inverted position. When all wirgrand components are in place, the mpleted chassis, still inverted, is sped into a pool of hot flux. Capilby action draws the flux up into the 1. In the third step, the chassis is sped into a molten solder pool and pillary action again draws the solr up into the pin. Excess leads are mmed after the solder has harded, in the fourth step, and the joint completed.

In replacing or removing componts, the dip-joint can be softened d resoldered from the bottom of e chassis with a small-tipped soldergiron or soldering gun, and the lead lled out from the hollow pin with ng-nosed pliers. The small mass inlived, plus the freedom from the ual twisting and crimping of leads, akes this an easy operation. On ound pins, more heat is required beuse the pin is directly secured to the metal chassis.

General Circuitry

The "EE" chassis and v.h.f. tuner, gs. 3 and 6, employ an improved adend using two r.f. stages with v-noise, grounded-grid input; four leo i.f. stages; automatic noise canllation, horizontal and vertical reace blanking, and delayed keyed g.c.

The built-in, continuous-tuning h.f. converter (designated "U.H.F.

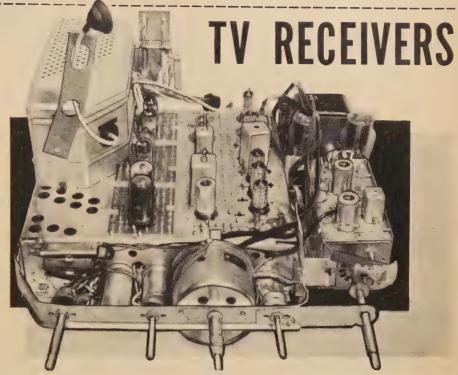


Fig. 1. The G-E dip-soldered "EE" chassis, used in its new TV line.

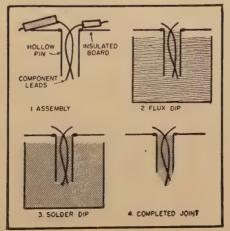
Complete service data on the new G-E TV sets, including circuit theory, schematic diagram, and service hints.

70") has, in addition to the continuous tuning range, two "click" positions which can be preset to any two u.h.f. stations.

Head end: The essential features of the "A/K" headend used in previous General Electric chassis have been retained in the unit employed with the "EE" chassis. This unit is a switchtype tuner, as can be seen from Fig. 1; its schematic diagram is shown in Fig. 6

One section of a 6BK7A (early production models use a 6AB4) is

Fig. 2. The four basic dip-solder steps.



used as a low-noise, grounded-grid input stage. The second section of this tube is not used. To obtain the best possible signal-to-noise ratio, the input stage is run wide open at all times; that is, a.g.c. voltage is not applied. The second r.f. stage, a pentode-connected 6AK5, receives a.g.c. voltage from a delayed system. Hence, this stage operates at full gain in weak-signal areas, delivering sufficient signal to the mixer (V_{103B} , ½ 12AT7) to override mixer tube noise and, on stronger signals, the a.g.c. delay is removed and the gain of the 6AK5 is reduced.

The output of the mixer is coupled to the first i.f. stage via a low impedance coaxial cable. This form of coupling, together with thorough shielding and lead filtering, reduces oscillator radiation to a minimum.

A 40 to 50 mc. trap, L_{106} , in the 6BK7A input stage suppresses signal pickup in the i.f. range and is factory adjusted to 43 mc. In localities where extremely strong signals in the i.f. range are present, added attenuation can be achieved with a shielded, plugintype high-pass filter which plugs into the headend input terminals at rear of tuner. This filter is normally not supplied with the receiver but is available from General Electric distributors, should it be required.

Fig. 3. Schematic diagram of the General Electric "EE" chassis. The tuner schematics are shown in Figs. 5 and 6. CONTROLS SET FOR NORMAL PICTURE
LINE = 117 VOLTS VI23 6AX4GT DAMPER NOTE: TE BE R183 +240V ← R153 85.87 F

vicing note: When replacing the headend in the field, the technic should make certain to wire tumper into the power terminals he headend that supply 250 volts in input stage. Omission of this ter, shown on the headend scheme, will cause extremely "snowy" tion in all but very strong signal

i. channel: With the exception of cow-impedance input circuit, bi-wound, single-tuned transformers cused throughout the stagger-ti.f. amplifier (see Fig. 3). Elimbon of the RC time-constant in rid circuits contributes material-improved noise characteristics by ving the possibility of griding. An a.g.c. voltage is applied te first three i.f. amplifier tubes. ree traps, tuned to 47.25 mc. (own 1) and 38 mc. (adjacent picture) encorporated in the i.f. amplifier.

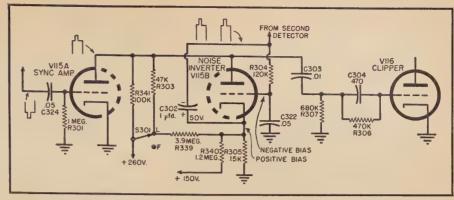


Fig. 4. Partial schematic diagram of the noise inverter circuit used in the G-E "EE" chassis. As shown here, sync pulses are fed to the inverter from two sources.

Since adjacent picture interference normally falls at 39.75 mc. the question arises, "Why trap 38 mc.?" Field experience has shown that, in nearly every case, adjacent-channel picture interference is encountered in

fringe areas where the desired signal is weak and the interfering signal is strong. Under such conditions, the receiver's fine tuning control is usually adjusted so that the desired picture carrier rides on the top of the i.f. re-

Table 1. Alignment procedure for the video i.f. and sound circuits of the G-E "EE" chassis.

	VIDEO I. F. ALIGNMENT								
TEP	SIGNAL GEN FREQUENCY	ERATOR CONNECT TO	OUTPUT INDICATOR	CONNECT TO	ADJUST ,	REMARKS			
1	41.25 mc. un- modulated	Junction of L ₁₅₄ & R ₁₇₈ & chassis	Oscilloscope	Test Point 5 (CRT grid)	L ₁₅₁ for minimum	Refer to the notes under alignment in the text			
2	47.25 mc. un- modulated	Same as above	Same as above	Same as above	L ₁₅₃ for minimum	May require maximum oscilloscope vert. gain			
3	38.0 mc. un- modulated	Same as above	Same as above	Same as above	L ₁₅₂ for minimum	Same as above. If insufficient "null" is obtained turn core of L_{154} two or three turns into coil			
4	4.5 mc. un- modulated	Test point 4 (diode load)	Same as above	Same as above (see remarks)	L ₁₆₀ for minimum	Connect network shown in Fig. 8 between scope input and receiver test point 5. Remove V ₁₀₇			
5	44.0 mc. center freq. 10 mc. sweep	Test point 2 and chassis through .001 μ fd. condenser	Same as above. Calibrate vert. gain of scope to provide 2-in. deflection for 1% volt peak-topeak input signal	Test point 3 (junction of R ₁₆₄ & R ₁₆₅)	T ₁₅₁ , T ₁₅₂ , T ₁₅₃ , & L ₁₆₇ for waveform below— 42 MC 40 % 40 % 40 % 40 % 40 % 40 % 40 % 45 MC 100%	Picture contrast control should be set to mini- mum. Apply a negative 6-volt battery bias to test point 8; connect positive lead to chassis			
6	44.0 mc. center freq. 10 mc. sweep	Test point 1 & chassis through .001 µfd. condenser	Same as above	Same as above	L ₁₅₄ and T ₁₀₅ (r.f. tuner) for wave- form below— 42 MC 42 MC 45 MC				
	SOUND I. F. ALIGNMENT								
7	Tune in a loca	al TV	V.T.V.M.	Test point 6 & chassis	L ₁₅₇ & T ₂₀₁ (top & bottom) for maximum	Voltage to be read is negative with respect to chassis			
8			Same as above	Pin 2, V _{118A} & chassis	T ₂₀₂ primary (bottom) for maximum	, , , , , , , , , , , , , , , , , , , ,			
9	V . "		Same as above	Test point 7 & center of two 100,000 ohm resistors, see Fig. 9	T ₂₀₂ secondary (top) for zero d.c. output	Remove 100,000 ohm resistors after alignment			

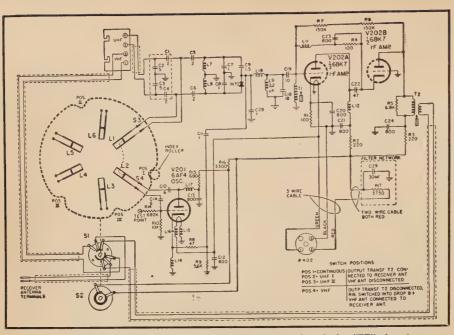
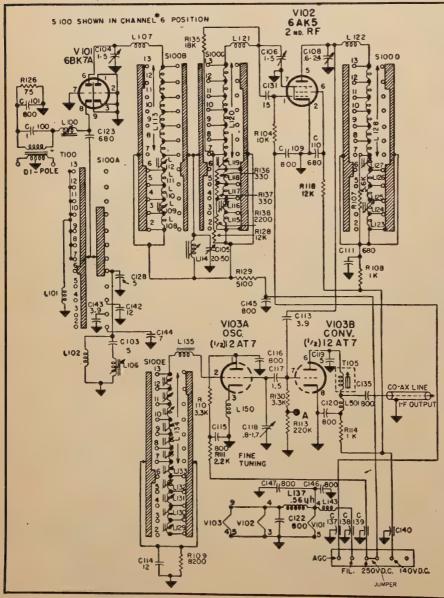


Fig. 5. Schematic of the G-E "U.H.F. 70" converter used with the "EE" chassis.

Fig. 6. Schematic diagram of the v.h.f. tuner of the General Electric "EE" chassis.



sponse curve to obtain more vide output. This point on the i.f. curv generally falls around 44 mc., as show in Fig. 7. This deliberate mistuning of the receiver also changes the frequency which corresponds to the interfering adjacent-channel pictur carrier. Thus, if the normal pictur i.f. is 45.75 mc., then adjacent-channel picture equals 39.75 mc. If, however the picture carrier is set to 44 mg the adjacent-picture frequency comes 38 mc. Hence, fringe tunir will drop the adjacent-channel sign. into the 38 mc. trap, whereas a 39. mc. trap would be ineffectual.

The approximate alignment frequency for each i.f. transformer pershown on the schematic, Fig. 3, to for cilitate visual alignment adjustment only. The use of an AM generator as single-frequency peaking is not recommended for over-all i.f. alignment The AM generator can be used, however, to adjust the traps.

Second detector and video amplifies Both 4.5 mc. sound and composis sync are taken off at the second detector, a 1N64 germanium diode. To sound signal is taken off through the 4.5 mc. tuned circuit L_{187} - C_{189} , and the fed into the 4.5 mc. i.f. amplifier, his iter, and ratio detector.

An a. c. coupling is used in the two stage video amplifier which consists the triode section of a 6U8 and 6AQ5 (later production models use 6CL6).

Noise inverter: Composite sync a video are amplified in V_{1154} , $\frac{1}{2}$ 12AT7, and fed across the noise verter to the clipper stage, V_{1164} .

The noise inverter, as the name is plies, actually inverts and cancello completely all noise pulses which a ceed the tips of the sync pulse. The circuit should, therefore, not be confused with other sync-stabilizing a rangements which simply clip or liminoise pulses to the sync level.

Referring to Fig. 4, the noise everter tube receives bias from to sources. A fixed, positive voltage applied to the cathode through to networks made up of R_{340} - R_{393} and R_{393} - R_{339} . Negative voltage which variable with the average signal level is from the second detector to the goof the noise inverter through for the noise inverter through for the noise inverter two the presence of strong, noise-fisignals.

In addition to supplying bias to be noise inverter grid, the second itector also feeds, from the sale source point, a negative-sync signithrough C_{302} to the cathode of 1 noise inverter. A strong noise purexceeding sync-tip level at the detector will, therefore, drive the cathod of the noise inverter less positical causing the tube to conduct heaven at the instant of conduction, 1 plate-cathode circuit of the noise overter looks like a low impedants. Since this low impedance path shut the output of the sync amplifier, 1.

(Continued on page 152)



By OLIVER READ*

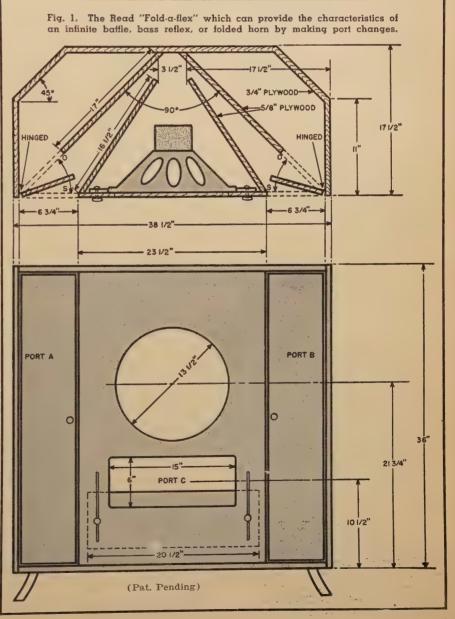
TLERS in high-fidelity compoents and systems are daily cononted with the problem of choosthe proper enclosure for a quality der installation. Consumers, too, very much in the dark when it is to making the proper choice of aclosure which will be best suited leir own room acoustics and to a particular listening criteria. The -1-a-flex," designed by the author, e result of experiments begun this year on an enclosure that thave its characteristics altered nome simple mechanical means. BREAD "FOLD-A-FLEX," Fig. 1, data accompanying this article is how a choice of any one of the most popular speaker enclosure s may be made.

Infinite Baffle

e design of a loudspeaker enclosand the choice of amplifier imnce must be based on subjective ments by the users as to what titutes "quality" or perhaps simdistening "satisfaction." An imporfactor determining the transient onse of a speaker and cabinet is amount of damping. The damping be changed by choice of amplifier edance and by adjustment of the stive component of the impedance. first design criterion which we ild attempt to meet is to expand low-frequency response to as low requency as possible. This means the value of the compliance for loudspeaker housing should be le as large as possible so that the pliance of the loudspeaker suspensets a resonant frequency. es for a completely enclosed box mmend a volume of 10 cubic feet more for a 15-inch loudspeaker. "Fold-a-flex" provides this type (Continued on page 176)

Editor and Assistant Publisher, RADIO & EVISION NEWS, RADIO-ELECTRONIC Patent Pending

An original design of an all-purpose loudspeaker enclosure t capable of providing the characteristics of: infinite baffle, bass reflex, or folded horn. Optimum performance of 12-inch or 15-inch speaker systems may be achieved by adjusting the variable port openings.





A "natural" for the photo lab, this timer requires no external power source and offers a wide selection of timing intervals.

OST electronic timers suffer from two disadvantages—they require a source of line voltage and they become extremely warm when left on for any length of time. Both disadvantages result from the necessity of using vacuum tubes and comparatively high voltages.

Although the necessity of having line voltage available seems like a small problem, occasions do arise when it is desired to control (turn "off" or "on") battery-operated or portable equipment over pre-deter-

mined time intervals.

The second disadvantage mentioned is of real importance in some applications. Anyone who has worked in a darkroom in summer soon realizes that any heat is too much! Yet it is in the photographic darkroom that a large percentage of electronic timers are employed.

With these problems in mind, an effort was made to design a timer that would meet the following specifications: (a) Simple in construction and wiring; (b) Easy to operate; (c) Completely self-contained, using no line power; (d) Generating as little heat as possible; (e) Rugged, yet compact. The result is shown in Fig. 1.

The timer shown in Fig. 1 is reasonably small (over-all dimensions of the case are 5" x 4" x 3") and lightweight, requires no line voltage, is easy to operate (only three controls -"Power" switch, "Reset" button, and "Time Control"), produces virtually no heat in its operation, and yet is fairly simple to wire (refer to the schematic diagram of Fig. 2).

All of these features have been made possible by employing a Raytheon Type CK722 junction transistor as a control element in place of the usual vacuum tube and providing for battery operation. Battery life is unusually long, since the maximum current drain is only slightly over a milliampere, and this only for short periods. In fact, the battery life should equal the normal "shelf life" of the units.

Circuit Description

The operation of the circuit is not at all complex, as can be readily observed by reference to the schematic diagram of Fig. 2.

In operation, when the "Power" switch, S2, is closed, current can flow through R_2 and R_1 , charging condenser C_1 and permitting a momentary surge of base current. The base current flow, in turn, permits collector current to flow, closing the relay.

As soon as condenser C_1 is charged. the current flow over the R_2 , R_1 , C_1 and the base-emitter path ceases. The drop in base current flow to virtually zero results in a corresponding drop in collector current flow, permitting the relay to open or "drop out."

The time period in which the relay "holds in" depends on the period of collector current flow, which, in turn, depends on the period of base current flow, and hence on the time it takes condenser C_1 to charge. This,

in turn, depends on the time co stant of C_1 , R_1 , R_2 and the base-em ter impedance.

TIMER

If any of the parameters in the I charging circuit thus formed a changed, then the time interval m be changed. In practice, an adjust able time interval is obtained by a ing a rheostat for R_2 , keeping R_1 , at small value simply to limit base cu rent flow and hence to protect t transistor. However, if fixed tir intervals are desired instead of continuously adjustable control, single fixed resistor may be used place of R_1 and R_2 , and different v ues of C_1 chosen by using a convex tional selector switch.

Once the unit is "set-up" for operation as described, the desired "tir ing interval" is selected by adjusting R_2 . The "Reset" switch, S_1 , is the depressed, shorting out and discharing C_1 . When the "Reset" switch released, C1 starts to charge agas and the relay closes, opening agaz after C_1 is charged. The timing it terval may be repeated as often a desired simply by depressing and r leasing the "Reset" button.

The layout and parts arrangemen used by the author are readily see by referring to the interior and ex terior photographs of the mode given in Figs. 3 and 1, respectively As is easily seen, no attempt wa made to "miniaturize" the model ar hence there is no crowding of part Because of this, wiring the un should be simple, even if the builde is not highly skilled,

Leads can be any length desired and the builder may use either "point-to-point" or "right-angle ca bled" wiring, or a combination oboth, as he prefers.

Although the author wired th transistor directly into the circui soldering the leads, the builder migh prefer to use a socket-an ordinar 5-pin flat subminiature tube socket employed. Should the builder follo the author's practice, however, tal care to keep the transistor leads least an inch long and do the solde ing as quickly as possible to avo overheating and damaging the tra sistor. Use the same "safety rule

receiver was constructed in a cabinet 8" wide, 8" deep, and 7" and having a hinged lid on top. en-ended chassis 7" x 7" x 1½" ttached to the panel by means switch and phone-jack mounto that the panel and chassis be removed as a unit. Because lange around the front edge of binet, it was necessary to mount strips 1/2" thick and 11/2" wide e floor of the cabinet running front to back to form a support e chassis. Access to a bindingstrip on the back end of the s was made by sawing a window 64" in the back of the cabinet ch from the bottom. Antenna attery terminals were mounted strip of Micarta, and soldering were used on the under side. g posts were made from 6-32 screws and knurled brass nuts from an old battery. Large were drilled in the chassis unhe binding-post strip to permit crip to be mounted flush. Two ded binding posts were attached y to the chassis beside the strip. igh this makes a neat arrangebattery connections could be by using flexible leads running kh a rubber grommet in the is directly to points where they it. A battery tray 3" x 7" was by bending up a sheet of alumi-It the long sides. This serves to batteries from sliding into the parts when the receiver is

I layout drawing and the photois show the mounting of essenparts. The arrangement used to be most satisfactory, and its short coil and detector ciritedads. Small variations may to be made, however, to accomite parts of different sizes. The condenser was mounted on an interpretation of the condenser was mounted on an interpretation. This bracket was and positioned with care in

R₁—1 megohm, $\frac{1}{2}$ w. res.

C₁—365 $\mu\mu fd$. section of dual-section
BC tuning cond.

C₂—133 $\mu\mu fd$. section of dual-section
BC tuning cond.

C₃—140 $\mu\mu fd$. var. cond.

C₄—200 $\mu\mu fd$. mica cond.

C₅—0.5 μfd . 200 v. cond.

C₆—1 μfd . 200 v. cond.

C₆—1. μfd . 200 v. cond.

C₈—1. μfd . 200 v. cond.

C₈—1. μfd . 200 v. cond.

C₉—1. μfd . 200 v. cond.

C₁—1. μfd . 200 v. cond.

C₁—1. μfd . 200 v. cond.

C₂—1. μfd . 200 v. cond.

C₃—1. μfd . 200 v. cond.

C₄—1. μfd . 200 v. cond.

C₄—1. μfd . 200 v. cond.

C₅—1. μfd . 200 v. cond.

C₆—1. μfd . 200 v. cond.

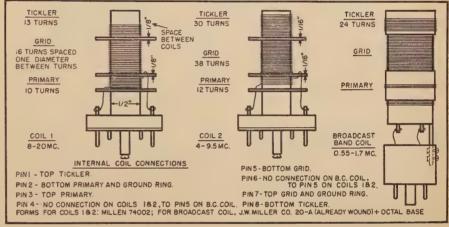
C₇—1. μfd . 200 v. cond.

C₈—1. μfd . 201 v. cond.

C₈—1. μfd . 201 v. cond.

C₉—1. μfd . 201 v. cond.

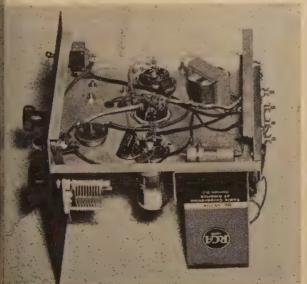
Schematic and parts list for regenerative receiver. The numbers in the tuning circuit refer to pins on the octal socket used for the coils. The proper tuning condenser for each band $(C_1$ or C_2) is connected through the coil form wiring (diagram below). C_3 is regeneration control. If set does not regenerate, reverse the connections of L_3 . Set should be connected to external ground by fairly short lead.



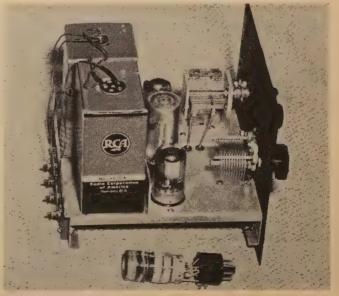
Coil diagram of the student receiver. The Millen forms have octal bases. Looking at the bottom of a form, with the octal key pointing down, pin 1 is to the lower left of key; other pins are counted clockwise from pin 1. The broadcast coil is ready-made (J. W. Miller Co. No. 20-A) and is attached to an old octal tube base.

order to align it properly with the flexible metal coupling between the vernier dial mounted on the panel. A (Continued on page 185)

om view of chassis, showing neat and roomy layout of parts. Fround object at left is the 7.5 mhy, plate-circuit choke.



Top view. Short-wave coil is in place, covered by a Millen shield which is part of coil form. Broadcast coil is in front.





Increase the sensitivity of older model receivers and sets in the fringe areas by adding a modern television booster.

"LEW LAMPS FOR OLD," the cry of the disguised magician in that delightful fantasy, Aladdin's Lamp, can today be echoed with a similar cry-"New TV sets for Old." But unlike the story, today's magic change need not be wrought with trickery; all it needs is a good, honest booster based on some firm, solid

Each year, in every progressive industry, some changes are made which tend to improve last year's product. Undeniably, the average 1953 television receiver is a more sensitive device than the sets of 1949, 1950, 1951, or 1952. The 1953 receiver also generates less internal noise than its predecessors and the combination of both these factors brings to the viewer a cleaner, more pleasing picture than he has had heretofore.

Now, you and I, and millions of other people, have television receivers which we bought in prior years and from which we still obtain a considerable amount of viewing pleasure. Perhaps our picture does not possess as much contrast as it could and perhaps it is spottier (with noise spots) than we care to have it. Still, this television set represents a substantial investment in many cases and few of us care to pay out more money for a new set when there is apparently so much "life" remaining in our present one.

So there's the dilemma. We would like to enjoy the benefits of the newest sets without being forced to spend a wad of money doing it. But can this

The answer is yes. It can be done

and at much less cost than most people would imagine.

Before we see how this can be done, let us determine what accounts for the somewhat poorer performance of the older television set. Assuming that your television set is operating normally and is not in need of repair, there are three factors which govern the quality of the picture you see. First, there is the amount of signal which your set is receiving from its antenna and obviously it cannot give you a full-blown picture from a halfbaked signal. In other words, if you are not getting enough signal at the input, you cannot obtain a clear, rich looking picture on the screen.

Second, there is the sensitivity of your set. If your set is sensitive, it will require less signal to produce the picture you want than if it is not very sensitive. Sensitivity is something most of us are familiar with because it applies to radio sets in the same way it does to television receivers. A highly sensitive radio set will work almost anywhere in a house; a less sensitive unit will bring in the weaker stations only in certain parts of the house.

The third important factor that determines the quality of the picture you see is the amount of noise the set itself generates. This may be news to some readers, but every electronic network develops a certain amount of noise voltage. In a television system this noise can be particularly bothersome because it will travel along with the incoming video signal and appear in the picture. Now, if the received By RICHARD C. KOCH

Senior Project Engineer Regency Div., I.D.E.A., Inc.

signal is strong, the noise spots (frequently called "snow") are "over powered" and are not visible to th viewer. But if the signal is weak then in a noisy set the noise will pre dominate and completely ruin you picture. A noisy, spotty picture is common sight in fringe or weak sig nal areas. But these are not the only places you see such pictures! Nois: spotty pictures are not uncommon even in relatively strong signal areas Sometimes it is the fault of the local tion; more often it is the set.

In a receiver, the noise that is do veloped by the first stage (the r amplifier) is actually the most impotant because at this point in the sys tem the level of the incoming sign; is more nearly on a par with the r ceiver noise level than it is at an other point in the receiver. Whatev: noise voltage is present at the inpr to the r.f. amplifier is amplified aloo with the signal and so, to obtain t best noise-free picture, we want have as much signal and as lit noise as possible at the front end l the set.

Now, of the three factors name the amount of signal your set receive will not be considered further because we will assume that a competent tee nician installed your antenna and th you are picking up as much of available signal as you can. T leaves set sensitivity and set no and any improvement in these qui tities will definitely improve the qu ity of your present picture.

Now, how can this be done? By stalling a well-designed, well-c structed booster between the anter and your set. But why a booster, ask? Because a booster will, as: name suggests, boost the amplifi tion of your set. Boosters are basical nothing more than r.f. amplifiers when you attach one of them to y set, you are, in effect, adding ona more r.f. amplifiers to the one alrepresent in your television set. The a booster will raise the sensitivity your present receiver, bringing more in line with the newer sets enabling you to obtain more contiin your picture than you did before

Sheer amplification, we have s is only half the story. Also to be sidered is the existing noise factor

set. Here again a well-designed. -constructed booster can be of imsurable assistance. For if the level of the booster is lower that of your set, it will add less to the weak incoming signal. h, by the time the signal reaches set, it will have been amplified he booster and be in a much betposition to override the receiver

short, by increasing the signal before it reaches your set, whatnoise is present in your receiver be less effective than it is when booster is present.

course, it is most important that booster itself have little noise, rwise you will gain nothing exa stronger signal with stronger b. But if the booster noise is low d it will be in a well designed then the improvement in picquality will amaze you.

hat booster manufacturers recogthis situation is amply revealed the following excerpt from the dature of one such manufacturer. states, in part, that, "The noise of finitial amplifier stages in the TV iver fixes the quality of reception. he noise factor is high, reception bor. A good booster not only supthe signal with sufficient r.f. gain vovercome the noisy television r, but possesses a low noise facto furnish the best in reception.' hus, boosters are designed with aims in mind: To improve the al-to-noise ratio and to amplify weak incoming signal. Both fea-s are important and both are fled. A booster capable of high d but incapable of providing a of signal-to-noise ratio will give a sure filled with disturbing noise s. A booster possessing a minimum Internal noise but capable of little a will not amplify the signal suffitly to permit it to override the set e. So again the picture will be ored with noise spots. Your booster it have both attributes or it might vell have none.

b show what improvement can be

achieved with a good booster, consider the figures shown at the top of the chart of Table 1. Here we have the sensitivities of an average television receiver produced in each of three years, 1950, 1951, and 1952. For each year the table lists the minimum required amount of input signal for three low-band and three high-band channels. These facts provide us with a fairly complete picture not only on how the average receiver performed on various channels, but also how its performance varied from year to year. Thus, here is what we know:

1. In any given year, the set required less signal to produce a certain output on Channel 2 than on any other channel. In 1950, for example, an input of 566 microvolts was required to produce standard output at the picture tube. On Channel 4 we needed 636 microvolts to do the same thing; on Channel 6, 672 microvolts; and so on up until, at Channel 13. 1250 microvolts were required. Obviously, the set was less sensitive as the frequency increased.

2. In each succeeding year, sets became more sensitive; that is, they required less input signal to obtain the same output. Even so, it still took over 300 microvolts of signal on a 1952 receiver to give you what we might term a good picture on the high band (all other things being equal).

The data given in the lower part of Table 1 shows the improvement wrought by the addition of a booster to the receiver. Compare first the 1950 receiver performance with and without the booster. Without the booster your 1950 receiver is relatively insensitive compared to a 1952 model.

But look what happens when you add a booster! Not only does the combination sensitivity increase, but you actually require less signal than a 1952 receiver needs to produce the same picture. Here you have, by the relatively simple addition of a fairly inexpensive booster, improved the sensitivity of a 1950 set so that it exceeds that of the much newer 1952

	WITHOUT 1	BOOSTER	
CHANNEL	195 0	1951	1952
2	566 μ v .	425 μ v .	150 μ v .
4	636 μ v .	496 μv.	175 μv.
6 7	672 μ v .	530 μ v .	200 μ v .
	1110 µv.		320 μ v .
10 13	1170 μv.	955 μ v .	
13	1250 μ v .		320 μ v .
	WITH BO	OSTER	
CHANNEL	1950	1951	
2	113 μ v .	85 μ v .	
4	127 μ v .	99 μ v .	
6	134 μ v .	106 μ v .	
7	278 μ v .	213 μv.	
10	293 μ v .	241 μv.	
13	313 μ v .	250 μ v .	
	-		

Table 1. Comparison of receiver sensitivity with and without booster. Improvement in sensitivity of 1952 when booster was added is not shown as the improvement was slight.

1			
CHANNEL	WITHOUT B	OOSTER 1951	1952
CHARMEL	1330	1901	1302
2	11.5 db	9.5 db	6.5 db
4	12 db	10.5 db	7 db
2 4 6 7	13 db	10 db	7.5 db
1 7	15 db	14 db	10 db
10		14.5 db	10 db
13	15.5 db	15.5 db	10.5 db
1	WITH BOO	OSTER	
CHANNEL	1950	1951	1952
2	6.5 db	6.3 db	6.1 db
4	6.5 db	6.4 db	6.2 db
4 6 7	6.6 db	6.3 db	6.2 db
7	8.8 db	8.5 db	7.9 db
10	8.9 db	8.7 db	7.9 db
13	9.2 db	8.9 db	8.0 db
13	5.2 ab	0.3 0.0	0.0 0.0

Table 2. Comparison of over-all noise figure with and without a booster in circuit.

set and this improvement is reflected on every channel. In many respects you get the benefits of 1952 set performance without expending the money needed to purchase a 1952 receiver.

What can be achieved with a 1950 set can, of course, be done with a 1951 set. Similar computations will show that the set of any year can have its sensitivity materially improved and this means that you can go as far back as the first postwar television receiver. As a matter of fact, the poorer the set sensitivity, the more marked the improvement when a booster is added as can be seen from Figs. 2 and 3.

Now let us consider the noise in (Continued on page 212)

Fig. 2. Television picture with heavy noise interference.

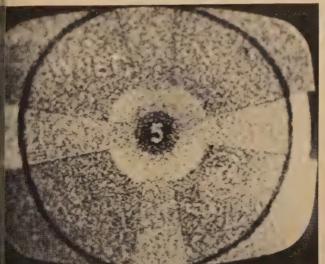
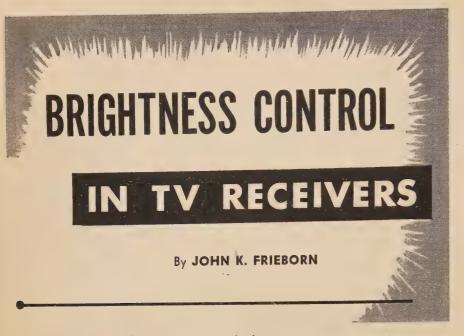


Fig. 3. Picture obtained after a booster was installed.





Explains the operation of the various automatic brightness control circuits used in TV receivers.

TYLES in automatic brightness control have changed. The circuits used in most receivers today are different from those used in most receivers a few years ago. The methods now popular are not new; they were used in early postwar production, but by only a few manufacturers. On the other hand, the methods which used to be standard still are being used in some receivers.

The new styles are not merely different in detail from those which used to be popular; they use a basically different approach to the problem. Automatic brightness control in a television receiver is needed to keep the average picture brightness not constant. but natural. When the brightness of the scene being transmitted increases, the brightness of the picture at the receiver should increase. However, the transmitted video signal does not allow us to reproduce the average brightness directly, except by using direct coupling in the video amplifier. Even that solution presents special problems of its own and does not, by itself, completely solve the problem of automatic brightness control.

Fig. 1 shows a typical video signal waveform for two picture lines. The dashed lines represent average brightness of the respective lines. This average brightness varies irregularly from line to line, according to the scene being transmitted. The minimum brightness or black level occurs at definite times (during the parts of the blanking pulses before and after the sync pulses). The maximum brightness has an identifiable amplitude (at the video detector output it is the minimum signal amplitude). If we keep the minimum and maximum brightness correct, the average will be

correct, provided that transmission and reception are linear.

There are several ways of keeping either the black level or the white level (maximum brightness) approximately constant. Most of them are based upon the idea of clamping some part of the signal. Clamping is, in effect, adding a slowly varying voltage, positive or negative, to the signal, so that the total voltage during the selected part of the signal always is approximately the same. The variations of the rest of the signal with respect to the clamped portion are preserved approximately as they were originally.

All of the old-style circuits are based on the idea of keeping the black level constant and practically all of them use sync pulse clamping. A simplified schematic of a typical circuit, the familiar diode d.c. re-inserter, is shown in Fig. 2. In this circuit, irrespective of the values of the a.c. and d.c. components of the signal at the plate of the video amplifier, the d.c. component produced by the varying charge on condenser C is just enough to place the picture tube grid at ground potential during the sync pulses. The blanking pulses make the grid somewhat positive. The picture tube cathode potential is adjusted by the brightness control so the blanking pulses bring the grid just up to cutoff, but not beyond. The peak value of the signal is adjusted by the contrast control to give the desired white

This method does not do everything required to keep the average brightness of the received picture natural under all conditions. It keeps the black level nearly constant, but the white level and average brightness vary with signal strength. To complete the job,

we must have a.g.c. in the receiver to keep the peak video signal output from the video detector constant.

Another minor defect of this circuit, even with a.g.c., is that it does not compensate for variations in blanking to sync pulse ratio. Fixing the sync pulse and white levels will not fix the black level unless the blanking pulse is a constant fraction of the sync pulse amplitude. If the blanking pulse amplitude decreases after the brightness control is adjusted, the retrace lines may become visible. If it increases, some parts of the picture which are supposed to be gray will be black and indistinguishable from the parts which are rightly black.

According to FCC standards, the blanking pulse amplitude is $75\% \pm 2.5\%$ of the sync pulse amplitude. If the station maintains this tolerance, sync pulse clamping keeps the blanking level at the grid of the picture tube constant within a volt or two and the variation is unnoticeable. The actual ratio in signals transmitted by certain stations in the past has varied from about 65% to 85%. This means a variation of \pm 5 volts or more at the picture tube grid, which produces a noticeable effect. (See Fig. 3.)

The black level can be kept constant by blanking pulse clamping, used in a few Sparton and Stromberg-Carlson models. The basic circuit, in Fig. 4, is similar to the one in Fig. 2, except for the amplified negative sync pulse applied to the plate of the diode. Because of this pulse, the cathode of the diode is not negative with respect to the plate during sync pulses, so diode current cannot flow then. It does flow during the blanking pulses, the part of the video signal which makes the cathode most negative with respect to the plate. In the same way as the circuit in Fig. 2 clamps the sync pulses, this circuit clamps the blanking pulses to ground potential at. the grid of the picture tube.

A different method of sync pulse clamping is shown in Fig. 5. In this method, the cathode and grid of a video amplifier tube are used the same way as the cathode and plate of the diode in Fig. 2. The positive sync pulses are clamped to ground potentia; at the video amplifier tube grid. certain potential at the plate of the video amplifier tube corresponds t zero bias on the grid, depending upog the tube characteristics and other civi cuit components. Sync pulses an clamped to this potential at the videl amplifier plate and the picture tuli grid. The blanking pulses make th grid of the picture tube more positiv. the exact potential depending upon the video signal. The brightness contr. places the picture tube cathode at potential positive enough with respeto the grid during the blanking pulsi to cut off the beam current. The r marks made in connection with F 2, about the effects of variations peak signal amplitude and in blar ing pulse to sync pulse ratio, a apply here.

eral other methods of sync pulse ng, including ones using separiode or pentode tubes, can be in various receivers, both old w

old-style circuits we have been sing up to this point use either ng pulse clamping, which is only er name for black level clampsync pulse clamping, which is simately the same. Most current ers use what might be called clamping for automatic brightontrol.

circuit of Fig. 6, used by rt-Warner, has grid-leak bias as he one in Fig. 5, but the phase signal at the grid of the video ier is opposite to that in Fig. 5. urrent flows not during the sync but during the parts of the signal corresponding to the est parts of the picture (the parts). The white level is d to ground potential at the amplifier grid and to correng potentials at the amplifier and the picture tube cathode.

blanking pulses make the picube cathode more positive by bunt depending upon the signal. id potential can be adjusted by ghtness control so the blanking just blank out the screen. A e in signal amplitude will cause prtions of the picture to become rk and make the retrace lines

matic gain control is even more ry in receivers having white ng than in those using sync lamping. Reference to Fig. 7 shes that for a given change in k value of the signal, the black thanges almost three times as when the white level is held at as when the sync pulses are

le clamping using grid leak bias picture tube is incorporated in rs made by Emerson, General Hallicrafters, Magnavox, Motorola, Philco, Strombergand Zenith, among others. shows a partial schematic of a used by Magnavox. When the ignal corresponding to a light the picture makes the picture thode more negative than the ectron flow from cathode to y rapidly makes terminal A of er C (and the picture tube less negative. During the rest video signal, electron flow R to terminal A very slowly erminal A more negative with to terminal B. The white level e is clamped at the picture hode to a potential very slighttive with respect to the grid rest of the signal makes the more positive.

if brightness control is adjusted the the positive cathode bias and the picture brightness, the innegative cathode potential the bright parts of the picture more grid current flow and ould-leak bias, returning the picture to its former brightness. This automatic increase of the grid-leak bias keeps too high a brightness control setting from pushing the light or medium gray portions of the picture up to the maximum brightness level. Too low a brightness control setting or too small a signal amplitude may keep the picture tube cathode from ever being driven negative with respect to the grid, so no grid-leak bias is produced and there is no automatic brightness

The term, "d.c. restoration," which often is used in discussions of automatic brightness control, suggests that an answer to the problem would be to use direct coupling in the video amplifier, so the d.c. component of the video signal would not be lost. Actually, direct coupling in the video amplifier has somewhat the same effect as white clamping. (See Fig. 9, the video amplifier circuit of Arvin chassis TE315-2.) In this circuit, the output of the video detector is most negative during the sync pulses, approximately 75% as negative during the blanking pulses. and approximately 10% as negative during the brightest parts of the pic-These voltages at the video am-

(Continued on page 193)

Fig. 1. Video signal for two picture lines

showing the change in average brightness.

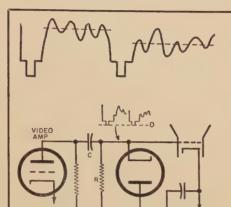


Fig. 2. Diode sync pulse clamping circuit.

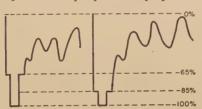


Fig. 3. Effect on black level of a change in blanking pulse amplitude percentage.

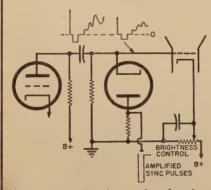


Fig. 4. Diode blanking pulse clamping.

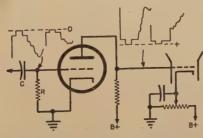


Fig. 5. Grid leak bias sync pulse clamping automatic brightness control circuit.

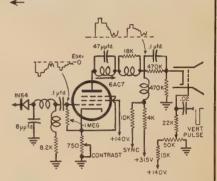


Fig. 6. White clamping type of automatic brightness control circuit used by Stewart Warner in their model 9202-C TV receiver.



Fig. 7. Effect of a change in signal level on the black level for circuit using (A) sync pulse clamping; (B) white clamping.

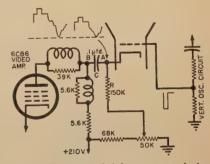
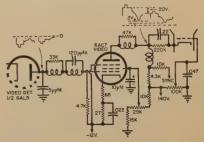


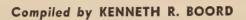
Fig. 8. Automatic brightness control circuit of the Magnavox 104 series sets.



Arvin's white clamping circuit.



International SHORT-WAVE



RNE SKOOG, DX Editor, Radio Sweden, tells me that the "Short Wave Game" (contest) sponsored by Teknikens Varld, Stockholm, last March was a great success with 1451 Participating stations contestants. numbered 24 from all parts of the globe. "The aim of promoting interest in short-wave listening was obviously reached, and our radio club has enrolled 2000 new members during the past few months, making a total of more than 15,000 members as of July," Skoog explains. It is planned to make this "Radio Game" an annual affair-with the 1954 competition set for the Easter weekend.

DX Program

Tentative plans have been made for your ISW DEPARTMENT editor to play a program of Christmas organ melodies, by tape transcription, in a special DX broadcast from HCJB, Quito, Ecuador, on Thursday, December 17 at 0330 (0830 GMT) with beam to Europe on 15.115, 11.915, 9.745; repeated 1600 (2100 GMT) with beam to the South Pacific on 17.890, 15.115, 11.915.

By that time, the move of transmitters to Pifo should have been completed, and reception reports will be especially welcomed. HCJB verifies correct reports 100 per-cent; an IRC is appreciated but is not required. More details next month.

This Month's Schedules

(Note: Some stations may have reverted to winter schedules and/or frequencies between the time this was compiled and now; in such cases, you may find some schedules one hour later than listed herein.—K.R.B.)

Afghanistan-Kabul Radio, 9.975A, is heard in Sweden 1140-1205 in English; starts with Eastern music, has news 1150, and Western music 1155; CWQRM. (Arvidsson)

Alaska-ALF, 5.260, Juneau, heard testing 0100; will QSL from Box 380. (Cain, Nevada) Better include return postage with report.

Algeria-Radio Algerie, 6.165, was noted 1830 with Eastern music; closed 1930 with "La Marsellaise." (Ferguson, N. C.)

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

Fourteen-year-old Bill Crowell, Harrisburg, Pa., now a monitor for RADIO & TELEVISION NEWS, became interested in short-wave listening as a result of the first "Boys' Life" Radio Listening Contest ("Boys' Life" is the official publication of the Boy Scouts of America). While he didn't do so well in the competition, Bill says he has found many hours of fun and excitement in pulling in distant stations and in receiving QSL cards and letters from the stations logged. He has logged 56 foreign countries. Bill types out his log sheets and puts them on the wall over his receiver for ready reference.





Anglo-Egyptian Sudan—Radio (durman now uses 6.438 and 7.664; English on Fri. 1230-1300, Sun., W at 1115. (Radio Sweden, others) He near 7.655 in Arabic at 1240 tune (Pearce, England)

Angola — Luanda, 11.862, is g strength in Sweden 1400-1430; bei and after that time has QRM fr BBC. (Arvidsson)

Argentina-Radio Splendid has g level 1630 on 9.320A; Radio Belgro 9.76, is fair signal 1700, and Radio Mundo, LRX1, 6.120, is heard v news in Spanish by woman 1700. (rentzson, Sweden)

Australia-VLC9, 9.615, is now u to Eastern North America 0700-08 to Western North America 1015-11 DX session Sun. 0830. (Belling N. Y., others) VLA15, 15.200, is ex lent around 2155-2315 to West Co (Bates, Calif.; Dannenfelzer, M VLC9, 9.615, is a satisfactory sig in Minn. around 0830. (Peters And in West Coast session 1015-1 (Smits, Minn.) VLB9, 9.58, noted v music 0725. (Frazier, Texas)

Austria — Blue Danube Netwo Salzburg, now lists channels of 9. 5.080, 6.055. (Pearce, England, other

Azores—CSA93, 4.865, Ponta I gada, noted closing 1800 with "A I tuguesa," weak level in Denma

Belgian Congo-OTC, 9.655, Leop ville, is excellent with English re from ORU, Brussels, Belgium, 20 2200 closedown. (Kirby, Mo.; Zer Pa., others)

Belgium-ORU4, 9.767, is good le to USA-Canada 1930-2200; Eng from 2000. (Kubachi, Mass.; Danr felter, Md., others)

Bolivia—CP38, La Paz, lists curi frequency as 9.444 on the air \$ 0755-0900, 0700-1600; weekdays 0 0815, 1030-1330, 1855-2200. (Bell ton, N. Y.) On a recent check, bever, seemed to be still on 9.497. 2000 where had bad QRM. (St

Brazil-ZYC8, 9.610, Radio Tan is heard as early as 1600 at good I but with some QRM from c.w.? (Gade-Joergensen, Denny PRK9, 15.190, noted with music: (Arvidsson, Sweden) F 9.72, Rio de Janeiro, noted with sical program 2200, with English Portuguese announcements. (Co Iowa) Radio Record, Sao Pauld been noted dual on 9.505, 11 around 1830.

(Continued on page 128)

RADIO & TELEVISION

THE OARAC

HE OARAC (Office of Air Research Automatic Calculator) is an electronic calculating machine (illusted on this month's cover) designed built for the U.S. Air Force by General Electric Company. It is able of solving the most complex thematical problems at speeds ch seem fantastic to those not actinited with the principles of electrics.

t may be said that OARAC has a 100 word memory with an average ess time of 9 milliseconds, that it multiply two ten-digit numbers in roximately 8 milliseconds, that it add two such numbers in less in 100 microseconds, and that it perform as many as 100 arithmeoperations per second. It might, vever, be more informative to look b this 1400 tube electronic giant in the eyes of a layman who has been read of a 10,000 word memory a 9 millisecond access time.

one of the first things to come to attention of our hypothetical layn would be the OARAC memory. s part of the computer (some call the "brain" or "heart" of the mane though that is hardly justified) ters around an aluminum cylinder in diameter and 30" long. This inder rotates at a speed of 3350 n and is coated with a magnetic de similar to that found on the es used in magnetic tape recorders. proximately 200 magnetic recordyback heads are spaced along the s of the cylinder approximately 12" from its surface. When a posior negative electrical pulse is blied to one of these heads the gnetic surface of the cylinder imdiately adjacent to the head is gnetized to form a positive or negve magnetic spot. Each of the 200 lds can write 2600 such spots around circumference of the cylinder. That total of $200 \times 2600 = 520,000 \text{ spots!}$ e same head reads back a positive negative electrical signal whenever of the magnetic spots passes beth it. Thus it may be seen that e a spot has been recorded on the inder it is available to be read k once each drum revolution there-

n the language of electronic comers, each of these 520,000 magnetic ts represents one "bit" (binary it) of information. In the OARAC, group of 52 bits is called a word ce, hence it may be seen that the RAC memory contains 10,000 word ces. Thus we say that OARAC has 0,000 word memory.

Since each spot on the memory cy-(Continued on page 180)

BERNARD H. GEYER

Electronics Laboratory, General Electric Co., Syracuse, New York

Capable of solving 1011 simultaneous equations, this ingenious calculating machine speeds operations for the U.S. Air Force.

HOW THE DIGITAL COMPUTER SOLVES A PROBLEM

OARAC is a large-scale digital computer with an extra-large memory. It can solve 1011 simultaneous equations. The simple illustration that follows will give you an idea of how the computer operates. Actually, the equation used might only be one thousandth part of a highly complicated problem.

In the equation-

 $y=3x^2+5x+2=[3x+5]x+2$

find y for all values of x between 1 and 1000 in steps of one.

The following information is stored at addresses in the computer's memory—a rotating magnetic drum:

Instruction					
Address	Number	Line	Address	Operation	Address
0000	x = 1	1	1201	21	0000
0001	999	2	1201	24	0003
0002	1	3	1203	22	0004
0003	3	4	1204	24	0000
0004	5	5	1205	22	0005
0005	2	6	1206	12	0006
0006	У.	7	1207	31	0006
		8	1208	21	0001
Key to Inst	ructions				
21 = put in	to accumulator	9	1209	23	0000
22 = add		10	1210	30	1215
23 = subtre	act				
24 = multiply		11	1211	21	0000
30 = choice	e (see further)				
31 = read	to tape	12	1212	22	0002
32 == go bo	ick to				
12 = write	into memory	13	1213	12	0000
34 == stop	and ring bell				
		14	1214	32	1201
		15	1215	34	0000

By turning a knob and pushing buttons on OARAC's front panel, the operator tells it to go to address 1201 and perform operation 1. It automatically proceeds from there to operation 2, 3, 4, and so on, performing the operations as follows—

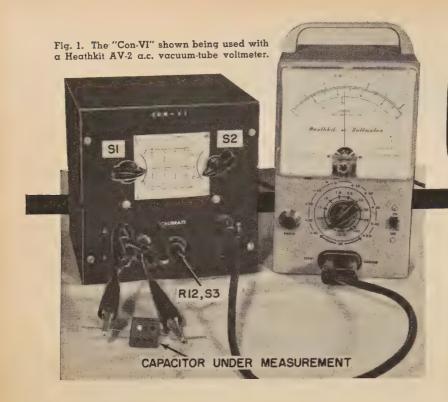
Number	Operation
1	"Bring what is at address 0000 into the accumulator." At this address the
	number 1 is stored. (x=1)
2	"Multiply the number in the accumulator by 3." Result: $3x=3$
3	"Add to what is in the accumulator, the number at 0004." Result
	3x+5=8
	"Multiply regult of energtion three by value at 0000." Result: (3x + 5)x=8

- 5 "Add what is in 0005." Result: (3x+5)x+2=10=y6 "Put answer at address 0006 on the magnetic drum."
- 7 "Record answer on magnetic tape for future printing." 8 "Put into accumulator the number at address 0001."
- 9 "Subtract x from that number." Result: (999—x)

 10 "Make a choice . . . if (999—x) is positive or zero, continue with operations 11, 12, and so on: otherwise perform operation 15, ringing bell to
- tions 11, 12, and so on; otherwise perform operation 15, ringing bell to indicate problem is finished."

 11 "Put x into accumulator."
- 12 "Add 1, giving (x+1), the new value of x."
- 13 "Record this at address 0000, making the new value of x available for calculating y."
- "Go back to operation 1 at address 1201."

From here on, the computer repeats steps 1 through 14 until x reaches 1000. Then operation 10 stops the calculation and rings bell to signal operator his instructions have been carried out.



By RICHARD GRAHAM

device to be described can be abbreviated somewhat. Let's refer to the unit as the "Con-VI" from here on in.

Principles of Operation

Whenever an unknown impedance, Z, is placed across a high impedance source, the voltage across the impedance Z is a function of the value. of that impedance. The high impedance source can be devised simply by placing a high resistance in series with the output of an audio oscillator. This is illustrated in Fig. 2A.

If the value of the unknown impedance, Z, is small in comparison with the internal impedance of the generator (which in this case is substantially 1 megohm) then the gent erator can be considered to be a conn stant-current source. Thus as long as the value of the unknown impedance Z, is substantially smaller than 1 meg ohm, the current, I, flowing is always substantially the same. If this is so then the voltage read on the v.t.v.m of Fig. 2A is directly proportional t the value of the impedance Z.

Now, if an inductance, L, is place: across the output terminals of a con stant current source, we note that the voltage appearing across the induo tance is:

> $X = E/I = 2\pi f L$ $E=2\pi fIL$

If the significant value of the vol age, as read on the v.t.v.m., is to be the same as the significant figure of th inductance, the $2\pi fI$ has to be magnificant. some power of 10. This can be easis accomplished by adjusting the output of the oscillator as shown in Fig. 2 to 10 volts. The current, I, flowing will then be 10 microamperes. No by choosing an oscillator frequency some multiple or sub-multiple of 159 the $2\pi f$ in the equation also become a power of 10. The significant figure of the voltage across the inductam of Fig. 2A is now the same as the significant value of the inductano The circuit shown in Fig. 2A is bas cally the same as that used in t "Con-VI" when measuring inductan

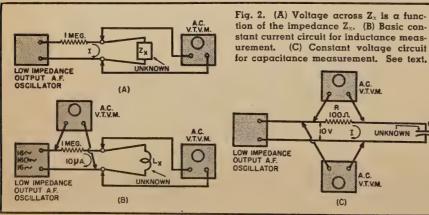
A condenser could be measured the constant current setup just (

Used in conjunction with an a.c. vacuum-tube voltmeter, this device permits direct reading of a wide range of L and C.

OME device for measuring inductance and capacitance is, of course, a necessity in any well equipped lab or shop. In places where "time is money" the speed with which the answer is obtained means dollars-perhaps in servicing jobs completed or engineering hours gained. But we've become so accustomed to thinking that only bridge type instruments are used for LC measurement that we are prone to forget that there is more than one way to "skin a cat."

The method described in this article utilizes a constant current and voltage source and an a.c. yacuum-tube voltmeter. The conditions of test are such that the value of unknown capacitance or inductance can be read directly on the scales of the v.t.v.m. Thus, this method features speed and convenience with fairly good accuracy. The full scale readings range from 10 millihenrys to 300 henrys, and 100 micromicrofarads to 3 microfarads. Furthermore there is no adjusting and juggling of any null or balance controls. This method, while not new, is worthy of review by busy service shops and labs and is ideal for a host of other production and industrial applications.

Basically the instrument is quite simple. It consists of an audio oscillator which will operate on three specific frequencies (more about this later), a power amplifier, and a power supply. The output of the power amplifier is either in series with a low resistance or a very high resistance, thus converting the oscillator into either a constant voltage or constant current generator. This rather lengthy and awkward sounding title for the



tion of the impedance $Z_{\rm x}$. (B) Basic constant current circuit for inductance measurement. (C) Constant voltage circuit for capacitance measurement. See text. UNKNOWN d, however the condenser value never be read directly off the of the v.t.v.m. A conversion would be necessary. This is bette the reactance of a condenser is sely proportional to the voltage it. A large meter reading indicate a small capacitance vice versa. By using a constant ge circuit, as shown in Fig. 2C, insers can also be read directly meter scale.

Fig. 2C, the current flowing is

Fig. 2C, the current flowing is ly proportional to the value of inser C_x . If there is no capacipresent, there will be no curflowing, and *vice versa*. This can pressed more rigorously by the wing:

 $X = E/I = 1/(2\pi fC)$ Fore: $I = (E) (2\pi fC)$

current can be determined by uring the voltage drop across a othm precision resistor, R, in series secondenser C_{α} .

the again by making the value of in the above expression a power the v.t.v.m. can be made directing. This condition is satisfied by the generator output voltage hal 10 volts, and making f a multiof 1592 as before.

r example to make the meter $100 \ \mu\mu$ fd. full scale, a voltage of olts with a frequency of 16,000 will cause a current of $100 \ \text{mi-}$ mperes to flow. This current hg through a $100 \ \text{ohm}$ precision for means that the meter when do not he $.01 \ \text{volt}$ scale will read $.01 \ \text{meter}$ full scale.

Circuit

of the functions shown in Figs. nd 2C have been combined into

12 AT 7 6AQ5 SL ≹R2 RIOS ₹RⅡ R3 V3 6X4 00 117 V.A.C. -100 ohm, 1/2 w. res. ± 1% (Aerovox Type CP1/2 T megohm, $\frac{1}{2}$ w. res. $\pm 1\%$ (Aerovox Type $CP^{\frac{1}{2}}$) -5000 ohm, 5 w. wirewound res. C1, C2-.002 µfd. silver mica cond. 8-02 μfd., 400 v. cond. C₄, C₇—24 µfd., 350 v. elec. cond. (Aerovox Type PRS) R_1 , R_4 —5 megohm, $\frac{1}{2}$ w. res. $\pm 1\%$ (Aerovox Type CP1/2) R_2, R_5 —500,000 ohm, $\frac{1}{2}$ w. res. \pm 1% (Aero-C5-.1 µfd., 400 v. cond. $C_5 = -5 \ \mu_1 d_1$, 25 v. elec. cond. C_8 , C_9 , $C_{10} = 20/20/20 \ \mu_1 d_1$, 450 v. elec. cond. $T_1 = Power \ trans. 240-0-240 \ v. @ 50 \ ma.; 6$ v. @ 2 amps. (Stancor PC-8402 or equiv.) $CH_1 = 7 \ hy$, 50 ma. filter choke (Stancor C1707) vox Type CP1/2) R_3 , R_0 —5000 ohm, $\frac{1}{2}$ w. res. $\pm 1\%$ (Aerovox Type CP1/2) R-10,000 ohm pot. (Centralab B-14) $R_0 = 50,000$ ohm, $\frac{1}{2}$ w. res. $R_0 = 20,000$ ohm, $\frac{1}{2}$ w. res. $R_{10} = 1000$ ohm, $\frac{1}{2}$ w. res. $R_{11} = 1$ megohm, $\frac{1}{2}$ w. res. PL_1 , PL_2 —3 w., 117 v. pilot lamp S_1 , S_2 —D.p. 3-pos. switch (Centralab 1404) S_3 —S.p.s.t. sw. (on R_{12}) V_1 —12AT7 tube R₁₂—500,000 ohm pot. (Centralab B-59-S) R_{13} —200 ohm, $\frac{1}{2}$ w. res. R_{14} —500 ohm, $\frac{1}{4}$ w. res. -6AQ5 tube -470,000 ohm, $\frac{1}{2}$ w. res. V3-6X4 tube

Fig. 3. Complete schematic diagram and parts list for the "Con-VI."

one unit to make up the "Con-VI." The schematic diagram of this unit is shown in Fig. 3.

A single 12AT7 serves as a Wien bridge oscillator which can be switched (Continued on page 162)

4. 4. Top chassis view of the "Con-VI" showing parts layout.

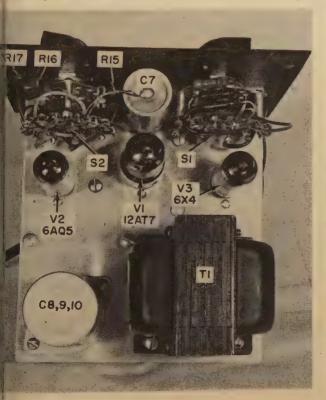
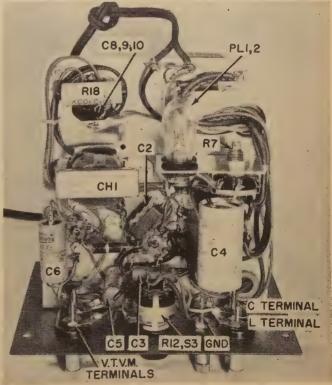


Fig. 5. Under chassis view of unit with major parts identified.





IDGET DAY" was what Barney termed it. He was referring to the fact that every set slated for repair that day was of the small a.c.-d.c. variety, and the youth was looking forward to a pleasant afternoon of "turning 'em out like hotcakes," as he put it.

However Mac, his boss, noticed that the boy seemed to be taking an unconscionably long time to cook the first hotcake. In fact, after probing and snipping and soldering on the small chassis for nearly an hour, he was looking more puzzled and exasperated every minute.

"Surely an electronic engineer of your caliber can't be having trouble with a simple midget set," Mac taunted him.

"Simple my eye" Barney exploded.
"This thing is about as simple as Sanskrit. It don't make sense. When you first turn it on, you can barely hear the local station; but the longer it runs, the better it gets. After it has been on twenty minutes or so, the sensitivity and volume gradually improve to where you can pick up several out-of-town stations, although the receiver is still not as hot as it should be."

"And what kind of a message do you get from these symptoms?" Mac asked with a quizzical grin.

"First I decided it must be a tube with low emission that took a long time to get hot enough to put out; so I changed all the tubes—but that was the only thing that changed. Next I concluded that perhaps an i.f. transformer had a defect so it was out of line when cold and sort of drifted in as the set warmed up, but that was a bum steer, too. I got to thinking perhaps there was a plate or screen-drop-

ping resistor that had a real high resistance when cold but came down to somewhere near normal when warm, but a careful check with the ohmmeter proved that hunch was no good. The 'B-plus' voltage is around seventy-five or eighty volts, which is a little low but not low enough to account for the deadness of the set when you first turn it on. That brings you upto-date on my thinking. No reasonable suggestion from those present will be ignored."

Mac pulled down the service manual that contained the diagram of the set and took a long look at it. Then he asked mildly, "Have you looked at this?"

"Who needs to look at diagrams of a.c.-d.c. receivers?" Barney scoffed. "I can draw every one of them with my eyes shut and recite 'The Shooting of Dan McGrew' backwards while I'm doing it."

Mac did not argue, but he took a small electrolytic condenser from a drawer and bridged it across one of the condensers in the little set. Immediately the volume increased at least four-fold, and the receiver acquired that between-stations hiss that goes along with good sensitivity.

"Let me have a gander at that diagram that tells you so much," Barney muttered as he reached for the service manual. After glancing at it for only a minute he looked up with a sheepish grin. "Now I get it," he said. "That dog uses a voltage-doubling rectifier, and where I was measuring 75 volts I should have been getting 190. One of the current-storing condensers is about gone. When cold, it has practically no capacity; but as it warms up it does achieve a microfarad or so, and then the voltage goes up and

gives the set more pep. And before you say it," he hurried on as Mac opened his mouth, "I know I should have turned to the circuit diagram when I first began to feel stumped, as you so often have told me to do."

"I might as well have saved my breath to cool solder joints," Mac complained. "Your trouble is that you are always letting what you think you know get in the way of a real chance to learn. Don't ever sell these little set short when it comes to giving you headaches. Many of them use almost identical circuits, but that just lull you into a condition where the occasional different circuit can waste a los of time.

"That set I just finished was a good example. It would play fine for a few minutes, and then the volume would slowly fade away. I shucked it out to the cabinet so I could get a good look at it, and then I noticed that just be fore the volume started to fade some of the tubes lighted very brightly while a couple of them became very dim."

"Doesn't sound so tough," Barner broke in. "Probably one of the headers was shorting through a cathod to ground and cutting heater current off the tubes that went dim. Since the voltage that used to be divided amorphant of them, these heaters naturally got brighter."

"That makes me wonder if I's starting to slip," Mac replied, "for miffirst thoughts followed exactly alor the same channel as yours. Ignoring the obvious fact that if a short of the nature was occurring the tubes with out heater current would have good clear out instead of just growing dir. I replaced all tubes that either green brighter or dimmer. When this makes no difference, I looked at the diagramand found out the two dimming tubes had 300 ma. heaters while the remaining 150 ma. tubes were arranged I two parallel strings in series with the starting sin series with starting si

"Normally this arrangement ga: each tube its proper heater current but now one of the 150 ma. heatet was intermittently opening. When did, it left only one 150 ma. strin in series with the 300 ma. tubes. Th meant that the current through t smaller heaters was greatly in exce of what it should be for them, but t the same time this current was inac quate to light the 300 ma. heaters normal temperature. It so happen that the tubes in the string that w cutting on and off had very dark buil that hid this action from sight. TI is the first time in a long, long till I have run across this deal in a radd although it is pretty common in

While Mac was talking Barney he replaced all the filter condensers the set he had been working on a had located an output transform with an open primary in an overgrown table model. He quickly

(Continued on page 192)

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TRANSISTOR POWER SUPPLY

By LOUIS D. CARCANO

VARIABLE-VOLTAGE power supp is highly desirable when experimen ing with transistor circuits. Sometim transistor circuits are critical as to vo Whether or not a given circuit critical, is an important thing to find ou Moreover, the first step in finding o whether a particular circuit is operab is to try varying the supply voltage.

The circuit illustrated is simple an compact. Because the current drain small and good regulation is not required, it is feasible to use a potention eter R₂ to vary the a.c. voltage to the power transformer. The bulkiest ar most expensive component, a "Varia or similar variable transformer, is th eliminated. The power transformer is small unit having a 117-volt seconda rated at about 20 ma., as well as a 6.1 volt secondary. The latter winding is n These small transformers a available as replacement types for I boosters, and also on the commercial su plus market. A small selenium rectifi and an RC filter complete the supp Hum is less than 2 millivolts. Maximu output is 40 volts, 5 milliamperes.

Metering of both voltage and load co rent is very desirable. A single me with a switch may be used, but separate

meters are better.

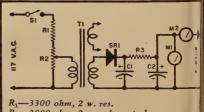
When operating an unfamiliar trans tor circuit, always make sure that the is enough resistance in series with 1 emitter circuit to limit the current to + rated maximum (usually 3 ma.) or ld Keep a current-limiting resistor in sen with the collector supply too. Before moving the resistance, make sure the reducing the resistance does not ma the current rise rapidly.

Always start out with the supply vo age turned down to zero, and after co necting the transistor circuit to the sa ply, raise the voltage cautiously, keepp an eagle eye on the current meter.

Never connect a doubtful transisi circuit to a power supply of this sort less the voltmeter reads zero. If the rent drawn by the circuit should he any tendency to "run away," the trans tor could be burned out by the cha: stored in the filter condensers.

Most of the newer circuits for junct: transistors require only a single poo supply or battery. Where a ground base circuit needs a separate emin source, a single flashlight cell is usua all that is needed in addition to the poo supply described here.

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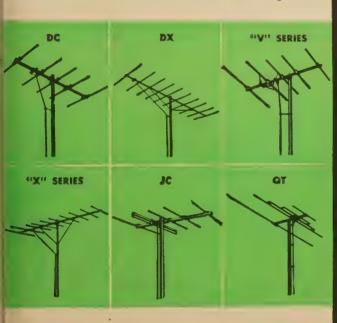
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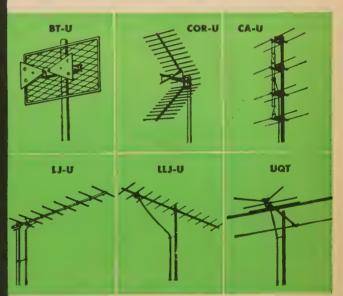
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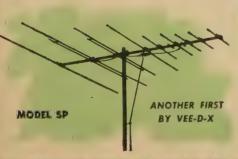
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HIGH-FIDELITY

By CHARLES E. COHN

WITH CRYSTAL HEADPHONES

Use these relatively inexpensive phones to provide hi-fi listening, record monitoring, or for private hearing.

PRYSTAL headphones of the high-fidelity type are capable of giving quality comparable to that obtained from the best amplifier-speaker systems. For this reason, they are useful for low-cost, high-fidelity listening, for recording monitoring, or for listening without disturbing others. However, this quality is not obtainable without certain precautions which will

be explained here.

The manufacturer's literature accompanying crystal headphones states that they may be connected into any tube circuit without affecting the frequency response. However, this is not quite true, as the impedance of these phones is capacitive and thus decreases with frequency. For example, the Brush BA-209 single phone (one unit of the BA-206 headset) has an impedance of 100,000 ohms at 1000 cycles and 10,000 ohms at 10,000 cycles. These specifications may be considered typical of all crystal phones. When these phones are bought as double headsets, they are connected in parallel, which means that the impedance of the headset will be 50,000 ohms at 1 kc. and 5000 ohms at 10 kc. Since these phones are flat across the greater part of the audio range with a constant voltage input, it is clear that these impedance characteristics will cause a considerable degradation of treble response if the phones are connected to a circuit having a high output impedance. For example, if this headset were driven by a pentode, its response would be 20 db down at 10 kc., with a high-mu triode it would be about 17 db down, while with a medium-mu triode it would be about 8 db down. This is clearly unacceptable performance, and shows that, despite the manufacturer's statements, these phones cannot be connected to just any circuit with acceptable results.

The ideal solution to this problem is to drive these phones with a cathode follower, but if the extra tube for this purpose is undesirable a compromise can be made. This can be done by replacing the original phone cord with a standard replacement cord, which would connect the phones in series instead of in parallel. Thus the impedances would be 200,000 ohms at 1 kc. and 20,000 ohms at 10 kc. This is still unacceptable for a pentode or high-mu triode, but with a mediummu triode will cause a drop of only 3 db at 10 kc., which is not too bad, and can possibly be compensated for by tone control adjustment or altering the de-emphasis network if the phones

are used with an FM set. The 6 d loss in audio volume caused by th series connection is, of course, unimportant if the system has any reservigain, as it should have.

The circuit which the manufacture recommends for headphone connectic is shown in the accompanying dis gram. The value of the blocking con denser is not especially critical, but t should be of high quality in order prevent damage to the phones through d.c. leakage. The 1 megohm resisted across the phones does not affect the response, but serves to prevent to large d.c. voltages from being built up across the phones in case of sligg condenser leakage. The manufactur states that this resistor can be r placed with a volume control, bl from the above discussion it is clear that such is not advisable, as it would lead to a great loss of treble with tit volume control turned down.

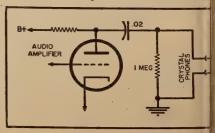
Audio levels required for normal I tening are about 3 volts for the parallel connection and about 6 for t series connection. Plenty of outprishould be available, as high-fidelil listening requires lots of volunt These phones can handle any output which the ear can stand.

In this article the author I tried to show how crystal phone can be used to provide fidelity comparable to the best presently averable. This information should be a particular interest to the high-fidelity fan with limited resources, as a pair of these phones and an I tuner can give him much listed ing pleasure while he saves up to be a good amplifier and speaker. Other cases where these phones would provide useful are if there is no room for satisfactory speaker enclosure, or the high volume which high-fidely fans like would cause trouble with 1 family or the neighbors.

REFERENCE

"New High Quality Headphone Receive Brush Strokes, September 1952 (Brush velopment Company)

Recommended phone connection circuit



CHECK THESE NEW Features

- Plays all record sizes, all speeds
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An entirely new introduction to quality record reproduction, a simple to operate, compact, table top model with none of the specialized custom installation problems usually associated with high fidelity systems. Two matched, synchronized speakers mounted in an acoustically correct enclosure reproduce all of the music on the record. Musical reproduction with the unique sensation of being surrounded by a halo of glorious sound. This spectacular characteristic is possible only because of the diffused non-directional properties of the matched dual speakers. The Heathkit Dual makes listening to fine recorded music a thrilling new experience through naturally clear, life-like reproduction of sound at all levels throughout the tonal system. The performance level is vastly superior to that of the ordinary phonograph or console selling for many, many times the price of the Dual.

Record Changer plays all sizes – all speeds – automatic shut-off for changer and amplifier after the last record is played. A wide tonal An entirely new introduction to quality record reproduction, a simple



range ceramic cartridge features an ingenious turn-under twin sapphire stylus for LP or 78 records without turning the cartridge.

phire stylus for LP or 78 records without turning the cartridge. Simplified, easy to assemble, four tube amplifier features compensated volume control and separate tone control. Proxylin impregnated fabric covered cabinet supplied completely assembled. You build only the amplifier from step-by-step construction. No specialized tools or knowledge required, as full recognition has been given to the fact that many purchasers of this kit enjoy good musical reproduction on a purely non-technical basis, and the construction manual has been simplified to the point where even the complete novice can successfully construct the Heathkit Dual. The price of the Heathkit Dual includes cabinet, —— Record Changer, two 6" PM speakers, tubes, and all circuit components required for amplifier construction. construction.

Benton Harbor 15, Mich. MAIL YOUR ORDER TODAY TO THE HEATH COMPANY SHIP VIA BENTON HARBOR 15, From Parcel Post MICHIGAN Express Freight ☐ Best Way OR PHONE RENTON 5-1175 PLEASE PRINT HARBOR PRICE WEIGHT DESCRIPTION MODEL NO. QUANTITY REMARKS TOTAL WEIGHT AND AMOUNT ... On Express orders do not include transportation charges — they will be Enclosed find () check () money order for collected by the express agency at time of delivery.

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"LPRS" Preamp Control (Continued from page 75)

compact, inexpensive, single-circuit selector switch. Long input cables can be used with magnetic pickups because of their low terminating resistors and with high-level inputs if the voltage dividers (or at least the series elements of the voltage dividers) are placed at the signal sources, since the lines then operate at low impedance. Crystal pickups can either be fed into voltage divider inputs, the tone controls being set more or less flat, or they may be fed into 15,000 ohm loads as recommended by Charles Boegli ("A Preamp for Magnetic and Crystal Pickups," RADIO & TELEVISION NEWS, July 1950) the tone controls then being set as for a magnetic pickup. Superior pickup damping is claimed for this latter scheme. Tests on the present equipment show good but inconclusive results in this regard. A final point concerns the "Gain" control. Its low value of 100,000 ohms was selected as it must drive the IRC loudness control.

Both "B+" and d.c. heater power are obtained from the power amplifier. It is necessary to obtain 150 ma. at 37.8 volts (in practice a somewhat higher voltage is designed for to allow for output tube aging) for the three 12SJ7's in series. Fortunately, the Williamson output stage has about 125 ma. at 39 volts available at the cathodes. Thus it is only necessary to add 25 ma. from "B+" through a bleeder, as shown in Fig. 4. The extra drain on the power supply is usually of no consequence.

Other power amplifiers may require somewhat different modifications, depending on the current and voltage available at the cathodes. It should be noted that the balancing circuit used requires the output tubes to be plugged in the right way. A 250-ohm dummy resistor is provided on the power amplifier chassis to replace the 12SJ7 heater string when the preamplifier is not used. A jumper plug, replacing the preamplifier power connector, makes the connection. Thus, a power amplifier converted as shown is not harmed in any way and may still be used as before.

TUBE TECHNIQUES

THE National Conference on Tube Techniques, sponsored by the Department of Defense, will convene at the Western Union Auditorium, 60 Hudson Street, New York 13, New York, October 13, 14, and 15.

The program of the meeting will cover all phases of electron tube making techniques, processing, and materials. Fifteen-minute papers on such subjects as cathodes, phosphors, vacuum techniques, glass-to-metal seals, insulators, etc., will also be given.

For further details on this conference, contact Harold J. Sullivan, Research and Development Board Committee on Electronics Panel on Electron tubes, 346 Broadway, New York. —30—

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HE RADIO CRAFTSMEN **MODEL C-800 TUNER**



Details on a high-quality tuner designed especially for custom fidelity systems.

INTEREST to devotees of high-fidelity reproduction is the recently developed C-800 FM-AM tuner, made by e Radio Craftsmen, Incorporated, Chicago manufacturer custom high-fidelity equipment.

The tuner circuit itself offers wider bandwidth, providing eater AM fidelity and sharper i.f. bandpass "skirts" for eater selectivity than its predecessor model, the Craftsn RC-10 tuner.

The instrument features separate tuned r.f. stages and ode converters on both FM and AM bands to insure low se level. A 10 kc. whistle filter is used to eliminate AM acent-channel heterodyne whistle.

A double-shadow tuning eye and no-drift a.f.c. on FM uplifies tuning. A front-panel control cuts out the a.f.c. en tuning weak stations. A completely shielded chassis sign, including a bottom plate, minimizes oscillator radion and helps to insure isolation. The tuner is highly histive—requiring only 5 microvolts to obtain a usable mal on either AM or FM.

The audio output is from a cathode follower enabling note installation and provides 2 volts at less than $\frac{1}{2}$ r-cent distortion. The detector output also provides a thode follower for recording applications. The output litches high- or low-gain amplifiers with input im-

dances of 10,000 ohms or higher. In addition to providing AM and FM coverage, this tuner so incorporates a phonograph preamplifier and record ualizer on the same chassis. The inverse feedback, comnsated dual-triode phono preamplifier provides correct rnover and roll-off characteristics to cover three of the ost often used equalization characteristics, the AES, LP, d European recordings. A front-panel switch permits e selection of any of these characteristics. Input jacks e also provided for television and "spare" (an additional

out that can be used if desired). The front panel controls are, from left to right; the ector switch, bass, volume, "on-off-treble," and tuning. te selector switch permits the choice of (in clockwise tation) FM, FM-a.f.c., AM, TV, LP, AES, European, and e "spare." The dual tone controls are continuously riable from 15 db boost through 15 db attenuation with

e flat position clearly marked.

The tuner uses fifteen tubes, a 6CB6, two 12AT7's, two A6's, four 6AU6's, one 6AL5, two 12AX7's a 6AV6, a

L7GT, and the 5Y3GT rectifier.

The entire unit is housed in a chassis measuring 13¾" x ½" x 7". It is also available with a mahogany-finished ood cabinet which measures 16" x 11¾" x 9¼".

107

REPLACEMENT CONTROL REQUIREMENTS **IRC Volume Control Plant** Asheville, North Carolina ALCOCATED TO From IRC's new volume control manufacturing plant comes your answer to all of today's replacement control needs. No other single source offers you a combination of such complete coverage, easy installation and trouble-free performance. Set servicing is simpler when you order IRC-most service technicians do. TYPE Q VOLUME CONTROLS MULTISECTIONS FOR STANDARD DUALS CONCENTRIKIT EXACT DUPLICATES FACTORY-ASSEMBLED CONCENTRIC DUALS 2 AND 4 WATT WIRE WOUNDS TV CENTERING CONTROLS HIGH VOLTAGE CONTROLS LOUDNESS CONTROLS TV ATTENUATORS SWITCHES SHAFTS BUSHINGS Send For New IRC Control Catalog DC1D THE CHIPPEN RESULT FOR MORE IRC CONTROL NEWS TURN NEXT

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BY JACOB H. RUITER, JR. of Allen B. DuMont Laboratories, Inc. 326 pages, 370 illustrations, \$6.00

Here at last is a book that makes it easy for you Here at last is a book that makes it easy for you to become expert in the many uses of the greatest, most versatile service instrument of all—the oscilloscope! It contains no involved mathematics. First, the author explains oscilloscopes fully—then gets right down to earth in telling exactly how to use them on AM, FM and TV service work. . from locating receiver troubles to aligning and adjusting the most complicated circuits.

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Expert knowledge of oscilloscopes helps you work faster, far more accurately and more profitably on all sorts of service and laboratory jobs. Basic subjects covered include: 1—Introduction to Oscilloscopes; 2—History of the Oscillograph; 3—Development of the Cathode Ray Tube; 4—Principles of Cathode Ray Tube; 6—The General-Purpose Oscilloscope; 7—Power-Supply Circuits; 8—Amplifiers, Attenuators and Positioning Circuits; 9—Time-Base Circuits.

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Each operation is carefully explained including the making of connections, adjustment of circuit components, setting the oscilloscope controls and analyzing patterns. About 400 illustrations including dozens of pattern photos make things doubly clear. Here are the specific how-to-do-it subjects covered: 10—Operation; 11—Interpretation of Basic Patterns; 12—Auxiliary Equipment; 13—Typical Applications in Electronics; 14—Servicing F-M Receivers; 16—Television Receiver Servicing; 17—Use of the Radio Transmitter; 18—Using the Oscilloscope in Teaching; 19—Additional Industrial Uses; 20—Photographing Cathode Ray Tube Patterns; (a) Glossary.

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"TELEVISION AND RADIO REPAIR-ING" by John Markus. Published by McGraw-Hill Book Company, Inc., New York. 544 pages. Price \$7.95.

This volume is a primer for wouldbe service technicians and is written as simply and clearly as possible so that the student will have no trouble handling the material presented.

The text material is progressive so that from the first chapters the student can begin repairing receivers, progressing to more complicated sets of all types.

The first two chapters comprise a down-to-earth survey of the servicing field, its opportunities, advantages, and disadvantages. They also cover tools required, service manuals, establishing credit, how to order replacement parts, etc.

The balance of the book is a step-by-step "guided tour" through radio and television circuitry expressed in the simplest, non-technical terms.

Since no previous knowledge of servicing or electrical theory is reguired of the reader, this book should be a natural for the beginner who wants to enter this interesting and profitable profession.

"NEW SCREEN TECHNIQUES" Edited by Martin Quigley, Jr. Published by Quigley Publishing Co., Inc., Rockefeller Center, New York 20. Price

This is a compilation of articles written by leading authorities on all phases of three-dimensional screen and sound techniques.

Included are papers on such subjects as "Polaroid" and 3D films, basic principles of 3D photography and projection, "Natural Vision," the stereo window, 3D in Europe, Cinerama, Cinemascope, sound for Cinemascope.

The text is lavishly illustrated and carries a preface by Dr. Alfred N. Goldsmith.

Those concerned with all phases of movie film and sound will find this symposium of value.

"AUDIO AMPLIFIERS AND ASSO-CIATED EQUIPMENT" compiled and published by Howard W. Sams & Co., Indianapolis. Vol. 4. Price \$3.95. Paper bound.

This is the Fourth Volume in the Sams library covering amplifiers and has been prepared for the audio engineer, service technician, and others interested in amplifiers and amplifier circuitry.

A cumulative index covering all four volumes is also included. Each amplifier is pictured with special controls identified, complete parts list, and circuit diagram.

This volume, used in conjunction with the other three books, will pro-

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ARC-3 PARTS	
T.206 Output XEMR.	# 55320
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T-103 Audio XFMR.	#55320\$2 #55548 #55545 #55546
T-105 Audio AFWIA. T-104 Modulation XF T-105 Side Tone XFM Driver Transformer, for Side-Tone Transformer,	MR. #55547 3
T-105 Side Tone YES	AD #55544
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• Driver Transformer, for	AKI-13, 1-202,
 Side-Tone Transformer, 	for ART-13, T-203
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456	
A AM 101A Antonnas for	CCD E33
PO 000 Indicators -/-	A DAL 0
BC 929 Indicators, p/o	APN-232
Modulation Transforme 456 AN-104A Antennas for BC 929 Indicators, p/o BC 451 Trans. Control	Box, p/o SCR 274N.
• FT-225-A Mounting R • FT-227-A Shock Mount	acks
FT-227-A Shock Mount	Racks
L 22 /A BC E Junction Boy	nauko
J-22/ARC-5 Junction Box	05
J-17/ARG-5 Junction Box	es 2
J-17/ARC-5 Junction Box MD7/ARC-5 Modulators,	all Tubes 5
MC 211 Right Angle Drive BC 433G Compass Revrs	S
BC 433G Compass Royrs	lised Excellent 22
ART-13 Barometric Limit BC 306 Antenna Loading	Switches
BO 306 Antonne Looding	Mait for DC 275
BC 300 Antenna Loading	Onit for BC 3/3 3
RL-7 Interphone Amplifi	ers, Usea, Excellent,
Less Tubes	
SA-4A/APA-I Motor Dri	ven (28 VDC) Yaqi-
Less Tubes	
MT-36-C Ant Loading III	nit for TA-21 XMTP 25
MIT-30-C AIL. Edading Of	
	for use with Mehile
A-62' Phantom Antennas,	for use with Mobile
XMTRS. 20-38.9 MC 4	for use with Mobile 0 Watts3
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PLATE TRANSFORMERS



(All primaries are 110 v. 60 cps, single pha DC ratings are approximate values obtained output of a 2-section choke input filter us MV rect. tubes.

	VOLTS	D.C.	D.C.		PR
TYPE	AC. R.M.S.	VOLTS	MA.	FIG.	PR
PT 175	550-550	400	150	В	5
PT 157	660-6601	500	250	В	100
	550-550	400			1
PT 158	11080-10801	1000	125	В	1.1
	500-500	400	150		
PT 159	900-900	750	225	В	
	800-800	600			
PT 167	1400-1400	1200	300	C	2
	1175-1175				
PT 168	2100-2100	1750	300	C	3
	1800-1800	1500			
PT 062	2900-2900	2500	300	D	- 4
	2385-2385	2000		1	1-
:Simuli	aneous ratin	gs			

FILTER CHOKES

(Smoothing)							
-	IND.	CUR.	DCR	TEST	1		
TYPE	HYS.	MA.	(OHMS)	VOLTS	FIG.	PRR	
181	10	200	140	3000	В	544	
182	1.0	250	125	3000	В	6.0	
183	8	300	80	3000	В	66	
	Swinging input chokes						
187	4-16	150	210	3000	В	3:1	
189	4-16	250	125	3000	В	6	
190	3-14	300	80	3000	В	6	
DVMANATORS							

DYNAMOTORS

ALL BRA	ND NE	W-0 F	RIGINA	L PACKI
INP	UT		OU	TPUT
TYPE	VOLTS	AMPS	VOLTS	AMPSP
	28	1.25	250	.060
DM 416	14	6.2	. 330	.170
DM 33A	28	7	540	.250
BD AR 93	28	3.25	375	.150
23350	27	1.75	285	.075
B-19 Pack	12	9.4	275	.110
			500	.050
DA-3A*	28	10	300	.260
			150	.010
			14.5	5.
5053	28	14	250	.060
PE 73 CM**	28	19	1000	.350

* Replacement for PE 94. ** Price sent on request.

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DIO AMATEURS' MOBILE HANDBOOK" by William rr. W6SAI. Published by Cowan Publishing Corp., York. 186 pages. Price \$2.00. Paper bound.

nis is a practical handbook for the mobileer and covers motive electrical systems, mobile power supplies, moreceivers, noise suppression, mobile transmitters and nnas, and test equipment for mobile equipment.

nce it is written by a ham for hams, the treatment is ise and fact-packed. The lavish use of circuit diagrams photographs helps to advance the subject matter rapand provide the reader with practical working dians of tested circuits for mobile use.

etails on commercially-built mobile equipment are also rided along with data supplied by the manufacturers nselves in a special "catalogue" section of the text. oth old timer mobileers and those about to join the ternity" will find this book of interest.

TO RADIO SERVICE DATA MANUAL" compiled and lished by Howard W. Sams & Co., Indianapolis. Vols. d 3. Price \$3.00 each volume. Paper bound.

ue to the immediate and enthusiastic acceptance of first volume of this series, the publishers have brought these two additional handbooks to cover most postwar receivers.

s was the case with the earlier volume, each set is picd, identified as to manufacturer, tube line-up, and inment data provided. A complete parts list with remement part numbers is given for each receiver in ition to the complete schematic and top and underasis views.

y adding these two volumes to his service library the inician specializing in auto radio work ought to be by equipped to handle any set that comes into the shop.

MANUFACTURERS' RECEIVER TROUBLE CURES" ed by Milton S. Snitzer. Published by *John F. Rider lisher*, *Inc.*, New York. Vol. 4. 115 pages. Price \$1.80. er bound.

this is the fourth in the current series of pocket-size dbooks for the service technician. As was the case with previous releases, this book lists specific cures for vice faults as devised by the manufacturer of the set

his volume covers Philharmonic, Pilot, Radio and Teleon, RCA Victor, Remington, Scott, Sears Roebuck, Senl, Setchell Carlson, and Shaw receivers.

subsequent volumes will cover other television receivers iufactured by other firms.

OST-OFTEN-NEEDED 1953 UHF CONVERTERS AND NERS" compiled by M. N. Beitman. Published by Sume Publications, Chicago. 96 pages. Price \$1.50. Paper

With new u.h.f. stations going on the air almost daily, need for information on converters and tuners to be d with v.h.f. receivers to provide u.h.f. reception is her urgent.

his volume covers the tuners and/or converters made fourteen companies, including mechanical and electri-

details on each unit.

n addition there is a section on u.h.f. transmission and eption, installing Admiral u.h.f. channel strips, anmas, and transmission lines.

PHILADELPHIA HI-FI CONFERENCE

dLADELPHIA'S Third Annual High Fidelity Conference and Audio Show will be held November 3rd and 4th at the ajamin Franklin Hotel in Philadelphia. The entire fourther has been reserved for manufacturers' use in presenting demonstrations for visitors. The Crystal Room will be as panel discussions and lectures by audio experts. omplete details on this event are available from Isadore ber, 105 Heatherwood Rd., Haverton, Pa.

109

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Manufacturers'

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

TUBES FOR U.H.F.

Sylvania Electric Products Inc., 1740 Broadway, New York, New York has recently issued a 16-page booklet entitled "Sylvania Tubes for U.H.F."

The publication provides information on the company's 6AN4 and 6T4 tube types which have been designed for v.h.f. and u.h.f. applications.

A copy of this booklet is available on request to the company direct.

WIRE CATALOGUE

A unique identification chart for electronic wire and cable is incorporated in the new catalogue No. 53 released by Alpha Wire Corporation, 430 Broadway, New York 13, New York.

This new approach to wire identification and correlation is set up on a two-page chart. It is designed to allow even the inexperienced to positively and quickly correlate one of the company's wires from a vague general description.

A copy of this 28-page catalogue is available from Dept. A of the com-

CATALOGUE SHEET

A four-page catalogue sheet which lists the firm's complete line of electronic equipment is now available from Perma-Power Company, 4727 North Damen Ave., Chicago 25, Illinois.

Items listed in the catalogue include a new TV voltage regulator, the company's deluxe model TV tube "Britener," the "C-Brite" tube "Britener," a TV insulated high-voltage grid cap assembly, etc.

Please make your request for a copy on your company or store letterhead.

ELECTRONIC

COMPONENTS SYMPOSIUM

The text of all papers presented during the 1953 Electronic Components Symposium is now available in book form from the 1953 Electronic Components Symposium, Suite 1011, 621 S. Hope Street, Los Angeles 17, California. The price is \$4.50 per copy.

The Symposium was held earlier this year in Pasadena under the joint sponsorship of the Radio-Electronic-Television Manufacturers Association, A.I.E.E., IRE, and the West Coast Manufacturers' Assn.

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Assurance is required that the relocation of applicant will not cause the disruption of urgent military project.

in the industry were presented at the meeting and included in this new publication.

PUBLIC SERVICE BOOKLET

CA Service Company is now distributing copies of a consumer booklet to TV service associations and hagers of Better Business Bureaus throughout the ted States.

ntitled "How to Give Your Television Set the Service Deserves," the 12-page booklet was prepared by the as a public service and a tribute to service technihs throughout the nation who have done such an outhding job in maintaining and servicing receivers,

the text is in a light vein with cartoon illustrations. It hts out that TV service technicians spend up to four rs in studying electronics to learn their work, and that y must take constant refresher courses to keep up on inges in receiver construction and new service data. addition, the booklet shows that the technician must est up to \$10,000 in equipment and facilities before can start business.

ther plans for the booklet include distribution to RCA vision dealers, spot announcements describing it on A-sponsored radio and TV shows, and in the company's

vspaper and magazine advertising.

ELECTRONIC COMPONENTS

Valdom Electronics, Inc., 911 No. Larrabee St., Chicago issued a comprehensive catalogue listing ready-top electronic components and "Croname" products.
Designated as Catalogue 5C3, the new publication lists

re than two thousand items in stock. Included are er assemblies; mask, glass, and escutcheon kits; title tes, dial and switch plates; knobs; instrument drives I dials; terminal lugs, cases and dial locks; terminal

Write the company direct for a copy of this catalogue.

"WHEN U.H.F. COMES TO TOWN"
Philoo Corporation has produced a new 15-minute eduional film for release to distributors in areas throughthe country where new u.h.f. broadcasting stations are ng on the air.

Intitled "When U.H.F. Comes to Town," the film dets the actual activity and excitement created in a comnity when a u.h.f. station starts broadcasting. It is de up principally of scenes filmed on the spot in new

.f. television areas.

The film is available in 16 mm sound for showing to TV lers and others interested in building up enthusiasm the new u.h.f. television service. The Sales Training partment of the company, Philadelphia, will provide litional information on how prints of the film may be nained for showings.

TRANSISTOR BULLETINS

Tlectronic Research Associates, Inc., Box 29, Caldwell, w Jersey is currently offering a new bulletin on availe types of transistors, manufacturers, and other supmentary data.

Also available is a several-page bulletin on the Model 1-11 transistor tester. Data is also provided on the del CC-60 constant current converter and the Model transistor power supply.

These bulletins are available from Dept. RN of the comny or by phoning Little Falls 4-1836, Caldwell, N. J.

TURNER CONVERTER (Turner Company, 900 17th Street, N.E., Cedar Rapids, va has announced the availability of a complete techal bulletin on its new u.h.f. converter, the Model TV-3. Copies of this bulletin may be obtained from electronic rts jobbers or by writing the manufacturer direct.

TRANSISTOR BULLETIN

Two new production types of hermetically-sealed, own-junction transistors are covered in Bulletin DL-S 0, recently released by Texas Instruments Incorporated, D Lemmon Ave., Dallas 9, Texas.

The publication contains two pages on the theory and

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Covers the Radio, Sound and Miniature Connectors that are available to you through Franchised Distributors, Electrical Wholesalers and Radio Parts Distributors.





FITTINGS: For audio, instrument and related uses. 3 contacts, 15a max., 14 basic shapes. Latchlock coupling. Available at your Radio Parts Distributor.





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FITTINGS: 3-contact oval-shaped plugs and receptacles, equipped with latchlock device. For microphones and related uses. 6 basic shapes. 30a max.

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FITTINGS: Designed in cooperation with RMA Committee, combining all features of P, O and XL Series. Gold plated contacts. Rubber relief collar and bushings.

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TEST POINT JACKS: High quality phone tip jacks to accommodate ATMA phone tip for laboratory uses. Rugged construction, nylon insulation precision-made for long life.

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SUB-MINIATURE SERIES: Gold plated contacts. Rack-and-panel or cord mounted disconnect for portable radio and related equipment. Hermetic sealed if desired.

Additional related audio and power Cannon connectors include Types X, XK, M1, GB and BP, all available through selected Cannon Franchised Distributors. See your classified telephone directory.

CANNON ELECTRIC



CANNON ELECTRIC CO., LOS ANGELES 31, CALIF. Factories in Los Angeles, Toronto, New Haven. Representatives in principal cities. Address inquiries to. Cannon Electric Company, Department J-145, Los Angeles 31, California.

application of junction transistors as well as detailed specifications and curves on the company's Types 200 and 201 n-p-n triodes with glass-tometal hermetic sealing.

A copy is available without charge from the company.

SUBSTITUTION CHART

A time-saving substitution chart for television picture tubes has been compiled by CBS-Hytron engineers and is now available without charge from distributors, or direct from the company's main office in Danvers, Massachusetts.

The 8-page chart includes all electromagnetically deflected tubes, irrespective of make. An index leads to the proper substitution group listing all readily interchangeable types, and from this group the service technician can pick an available type with the least number of required service adjustments.

SHURE CATALOGUE

Shure Brothers, Inc. has just issued a new general catalogue, No. 44.

The publication covers microphones, microphone parts and accessories, phono cartridges and pickups, wire and tape recording heads and lists replacement information on phono cartridges, communications microphones, and magnetic recording heads of various manufacturers.

The catalogue is designed to be of maximum value to distributor countermen and salesmen, service technicians, sound dealers, hams, hobbyists, and engineers.

Write the company at 225 W. Huron St., Chicago 10, Ill. for a copy.

STANCOR TRANSFORMERS

Chicago Standard Transformer Corp., Standard Division, Elston and Addison, Chicago 18, Ill. has issued a 24page catalogue listing complete electrical and physical specifications on almost 500 Stancor transformers.

Included in the listing are transformers for radio, television, high fidelity, amateur, military, and other electronic applications.

A cross index chart between obsolete power transformers and the current "8400" series power transformers has been included in the catalogue.

It is available without charge from Stancor distributors or from the company direct. * * *

TAPE ERASURE

Minnesota Mining and Manufacturing Co., 900 Fauquier St., St. Paul 6, Minn, is offering a copy of its "Sound Talk" bulletin No. 24 to interested persons.

This particular issue deals with the a.c. erasure of magnetic tape and describes the theory and practice of a.c. erasure. It covers such points as orientation, speed, and the number of passes required. In addition, procedure for obtaining best results both with 60-cycle bulk erasers and with machines is outlined.

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With the New Improved 1954 \$ 09 Progressive Radio "EDU-KIT"

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THE KIT FOR EVERYONE

It is not necessary that you have even the slightly background in science or radio. The "Edu-Kit" is us by young and old; by radio schools and clubs; by Veterans' Administration for Vocational Guidance Training. No instructor is required. Instructions complete, simple and clear. You cannot make a mistal

PROGRESSIVE TEACHING METHOD

PROGRESSIVE TEACHING METHOD
The "Edu-Kit" uses the principle of "tearn by 'ing." Therefore you will build radios, perform jand conduct experiments to illustrate the princic which you learn. You begin by learning the funciand theory of each of the radio parts. Then you be a simple radio. Gradually in a progressive manner, will find yourself constructing more advanced multi-radio sets, and doing work like a professional Raf Technician. The "Edu-Kit" instruction Books are ecedingly clear in its explanations, photographs diagrams. These sets operate on 105-125 V. AC-DC.:

The Progressive Radio "EDU-KIT" Is Complety You will receive every part necessary to build fit different radio sets. Our kits contain tubes, tube seets, chassis, variable condensers, electrolytic condenser mica condensers, paper condensers, resistors, line conselenium rectifiers, tie strips, coils, hardware, tube hook-up wire, solder, etc. Tools are included, as well an Electrical and Radio Tester. Complete, easy-to-foliunstructions are provided. In addition, the "Edu-now contains lessons for servicing with the Progressignal Tracer, F.C.C. instructions, quizzes. The "E' Kit?" is a complete radio course, down to the smars detail.

TROUBLE-SHOOTING LESSONS

TROUBLE-SHOOTING LESSONS
Trouble-shooting and servicing are included, will be taught to recognize and repair troubles, will build and learn to operate a professional Sistracer. You receive an Electrical and Radio Tevand learn to use it for radio repairs. While you learning in this practical way, you will be able to many a repair job for your neighbors and friends scharge fees which will far exceed the cost of the "It Kit." Our Consultation Service will help you with the technical problems which you may have.

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ADDRESS

PROGRESSIVE ELECTRONICS CO

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RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

ERYTIME we wade into a batch of statistics to try to interpret how contemplated or possible industry develients are likely to affect the business of independent vice dealers, memory always brings to mind a discussion nortality rates in combat that we sat in on during our

It in service during the recent world war.

was a bull session in the barracks. The outfit was le up largely of airborne radio operators, potential and belly gunners, and various and sundry specialists combat aircraft maintenance. The talk turned to ships in combat when one of the outfit's military masterds came out knowingly with a lot of statistics about comparatively low mortality rate among air force

finally one of the boys who was ticketed for early oment as a replacement in a combat outfit, said:

Those statistics are a lot of bunk to me. If I get in road of a slug and can't come back under my own ver as far as I am concerned the mortality rate is

Future and Independent Service Although television has steadily advanced since the eze was lifted last year, the mortality rate among all service businesses has increased since the presistial election year "boom" in service started to taper after the turn of the year. Percentage-wise, the busismortality rate has been 100% for each of those piring technicians who launched out on his own as an sependent operator and "fell by the wayside" as busias steadily tightened up.

3ut all forecasts for Fall business are very optimistic. th more than twenty-two million sets in operation, re will probably be a big rush for service when the tball season and World Series stimulate a new inter-

in TV and in picture quality restoration. A recent forecast of sales of TV sets during the comfour years indicates a possibility that thirty million vs will be sold during that period, providing a "mild cession" doesn't occur with the easing of international Against this volume of sales, this forecast imates that about 4,000,000 older sets will be junked d destroyed. On the basis of these estimates, about y million TV sets will be in use by the beginning of

It is, of course, impossible to measure at this time the ect color television developments will have on the sale monochrome receivers. The National Television Sysns Committee (NTSC) filed a petition with the FCC e in July for the establishment of standards based upon system of compatible color television. RCA, who had ed their petition late in June, amended it slightly to nform exactly with the NTSC proposal. That the entire dustry was backing the NTSC standards was clearly own when Dr. Peter Goldmark, chief engineer of the 38 laboratories which developed the FCC approved CBS stem for color TV, seconded the motion to accept the TSC committees' recommendations for presentation to e FCC

With the electronics industry solidly behind it there ems no doubt that the NTSC color TV system recomendations will get early consideration from the Federal



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MORE IRC CONTROL NEWS TU NEXT PAGE

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 1.5X full screen without distortion.
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 CONTINUOUS CURRENT RATING: 10 A at 6 V. 6 A at 12 V.
- V, 6 A at 12 V.

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- once your new 1954 catalog

Concord Radio 53 Vesey Street Phone New York 7, N. Y. Digby 9-1132 Communications Commission and all necessary steps leading to its acceptance will be completed at an early date. Then the big question will be-When the average prospective TV buyer sees a color receiver in operation will he put off buying a monochrome receiver and wait until he can get a color set?

However, no matter what happens, the market for service will continue to grow. TV sets that are kept in service for long periods of time will require more and more major service jobs to keep them operating. And as color television sets become available they will require a new level of technical competence and provide more volume for the capably managed shops.

Major Service Jobs

A TV service job that costs twentyfive dollars or more usually puts quite a strain on the budget of the average family. The American system of time payment purchases has developed a national habit of regularly splitting up the pay check to pay for many things on easy payments.

Automobile manufacturers realistically solved the problem of helping car owners finance major repair jobs by making car repair finance plans available through their regular financing agencies. This, of course, helped the car dealers retain their service customers but it was no help to the independent garages.

Here's how credit facilities were made available to independent garages according to Mr. Charles M. Cawley, vice-president of the Beneficial Management Corporation, in a speech before the National Sales Executives Convention:

"Not too long ago, the independent car repair business was losing ground to the large auto dealer franchises. A survey by a national magazine showed that the independent garage dealer's share of the auto repair business had dropped from 65% of the prewar market to a low after the war of 35%.

"One of our clients — a manufacturer of automotive parts - was disturbed about this trend, as well he ought be. He sells his product largely to independent garages, and they, in turn, install them in cars brought in for servicing and repairs. The less business they did, the fewer units he sold. And based on the trend, he was going to sell less in the future.

"An analysis of this situation convinced this manufacturer that the only way his independent garage dealers could compete with large automobile dealers was to have all of their advantages. This meant, among other things, a sound credit plan-which most of the independent garage dealers did not have.

"Therefore, between us we created a Car Credit Plan for garages. This is sold as a part of the merchandising package which the manufacturer makes available to his dealers. The manufacturer's salesmen back up the



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SPECIAL 500 Kc. Crystal
All above crystals sent postpaid in U. S. only.
available in complete sets for SCR-608. SCR
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Illuminated TUBE & SET TESTER
Tests all latest tubes. Seven in. multi-test
tests DC 0-2.500 V, in 7 ranges. AC 0-2.5
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Excellent cond. With conversion data. 65.4.
PEPER TRANSCEIVER. All
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PER C. 6 or 12 Vinput. Output, positive.
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with spare parts
BC-603 10-METER TANK RECEIVER. Freq.
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MINIATURE 6 V. WET CELL BATTERY. WITH
TeV. DC motor. F.B. for R/C boat. 31/2/X21/8/
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BD-77 DYNAMOTOR. 12 V. input, 1,000 V. @ 350 mils, New.

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tage by merchandising the credit plan to the local ers—explaining its advantages, giving full details of operation, and holding meetings to tell them how rs have used it successfully."

any service dealers have plans of their own which he the set owner to buy a new picture tube on a thly payment plan. However, a service business ld have to have substantial cash resources to handle kind of financing themselves. Usually, arrangements made with the dealer's bank to handle this "paper." ks and financing agencies have both the facilities and proper psychological atmosphere for handling colons.

ne important thing about any time payment plan is it must be simple and the credit information assemand passed on without embarrassment to the cuser. Most people are annoyed when they are asked to ish information about themselves for a credit report, it dealers handle this smoothly by calling their credit ements "Let's Get Acquainted" Reports and the periel who handle them are thoroughly indoctrinated how to get the needed information by "getting active the customer.

ct of Doing Business

the continuing surveys conducted by your editors to her specific information on all phases of electronic ice business operation one of the most important but ive factors is the cost of making home service calls. appalling to find that only a very small percentage ervice dealers know what it is actually costing them to business.

he more successful businesses, of course, know their s. The following breakdown recently furnished us by pajor service business in a metropolitan city, details or cost of handling home service calls. These figures based upon 1000 calls and the time factor involved tudes time spent checking in and out, in handling exages of parts, etc. The time averages out at 1½ hours call. Here is the detail and the total cost-per-call this company:

% hrs @ \$2.00 (minimum scale)\$2.25imiles travel @ 7c per mile.56ispatch & management of routes.40ilerical, bookkeeping, rent, heat, light, and.76dvertising.50tepreciation & investment.18

It actually *costs* more than \$4.50 to handle home servcalls how, you may logically ask, can those technicians rate who advertise home service calls for \$2.50 or 0?

an effort to find some answers to this question your cors recently contacted nine TV technicians in a lium-sized city who were advertising home services for \$2.50. It is interesting to note that although every of these men claimed he was making a good living dling service at \$2.50 per call, five of them had plans discontinue their independent work as soon as they not jobs that would pay eighty dollars per week or the contact the conta

he illusion that leads technicians to feel they can ke more money "on their own" by handling service s at \$2.50 each is explained in this composite analysis hinking composed of the information developed in all these interviews:

Vhile working for a regular TV service dealer the inician averages 8 calls per day for which his boss

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collects \$5.00 per call plus the pro on the tubes and parts used in serv ing the sets. The technician reason that where he is making eight calls day working for someone else, could work a little harder working himself and average 10 calls per d

At ten calls per day, he reasons, will make \$25.00 a day for his la plus the profit on the tubes and pa he sells. He concludes that by wo ing six days a week he will get \$150 for his labor and the profit on tu and parts will pay his operating penses.

The delusion occurs after he tried for ten months to make his come take care of his outgo work

at \$2.50 per call.

The fundamental fault of this k of reasoning is the assumption t day-in-and-day-out, Spring, Sumn Fall, and Winter-throughout the weeks of the year-ten TV set own will call him for service. It doesn't work out that way.

If a technician is able to aver-ten sets serviced in the home day to the satisfaction of the owners, that is his maximum potent of business, operating alone. Fit the limited funds available to from his maximum potential the vertising he can buy would not I duce an average of one-third, 3 ca consistently throughout the year. S? every once in a while when every seems to need TV service at the sa time and all shops are swamped,i will be exposed to more business t' he can handle. But those are rare stances. Averaged out over a year business of six sets per day is diffif to maintain for the independent to nician with limited promotional l sources.

The final results are usually same: At the end of a year the to nician who started out on his with inadequate resources has a w out car, debts, and a yen for a

with a guaranteed salary.

We would like to point out, thou that there are some exceptionally men who operate successfully as man TV service businesses. But r of these men handle service fci group of reliable set dealers and subsequent COD service for t dealers' customers after the sets s out of warranty. By maintaining mailing list of all of the set purcha they have handled for dealers are able to confine their sales motion to users they have worked and who are acquainted with th And it is interesting to note that of these people your editors have ! tacted get \$5.00 per call for hl service.

TV Service Is Complex Business

The operation of a successful service business is a complex un taking. In the first place, it requ substantial financing. The studie successful service businesses made your editors in all sections of country show that a ten thous (a capital investment is nominal. Managers of service esses employing only four technicians are usually of their ability to hold their replacement tube, and equipment investment down to only \$3000. elicians working on their own with limited stocks lose re part of their effective working time in trips to houses to pick up needed parts or tubes.

biggest problem that faces any service business is of maintaining an adequate volume of business. As one quipped the other day, "It certainly pays to tise. There are 26 mountains in Colorado higher Pike's Peak." But advertising can be both expensive heffective. A service business needs a service selling am that is designed for its individual needs and sec-

Merely advertising doesn't pay off.

vice organizations capable of supporting four or technicians have proven to be the most consistently rssful television service businesses. This size organi-1, with an adequate business control system, permits man to give his time to the phase of the work for he is best qualified and allows the operating execufime to devote to the task of maintaining the volume rvice work that the organization requires to pay its

wner Education

most important part of the job of public relations Chalf of independent service that needs to be done is equaint the public with what they should expect to for competent service. They have been given no stick with which to measure whether a service ge is low or high. In buying service on their cars, have been educated by auto dealers to pay a flat rate arious types of service plus the cost of the parts and lies needed.

le American public has acquired an interesting "price aisal habit." If they have been educated to pay a in price for a particular kind of service and have I that service to be satisfactory at that price, they be skeptical or suspicious of anyone who offers to perthat same service for less money. Most everyone been stung sometimes by an "I'll-do-it-for-less" char-

se education of the public about what to expect to pay competent TV service must be done by the independservice operators themselves. Legal restrictions prethe industry as a whole from promoting this type of

mpaign.

metime ago the Bureau made a national survey of standard charges for TV service operations that orzations in different sections of the country are using. rages of these charges were used in developing a dule of average charges. This schedule was made up chart titled the "Standard Labor Charges for Televi-Service and Repairs."

undreds of service dealers bought these wall charts asked about a mailing piece listing these charges that d be mailed or given to TV service customers. This thas been reproduced as an 8½ x 11 flyer which, ed three ways, can be mailed in a standard #10

elope.

ne chart is also available in the form of a printing Some service businesses wanted to make up their mailing pieces. They can do this by writing their own v to go on one side of an $8\frac{1}{2}$ x 11 flyer, and their ter can cast type from the mat to print the standard r charges schedule on the other side of the flyer.

hese mats are available from the Bureau at \$2.00 1. For information about it address your letter to: LB Information Services, P.O. Box 1321, Indianapolis ndiana. Please enclose a stamp or a stamped envelope reply.

V Consumer Booklet

he RCA Service Company recently announced a new sumer booklet that lauds the independent TV service mician and tells an interesting story about what the technician does, to provide competent TV service. gives a graphic presentation on Pages 10 and 11 of

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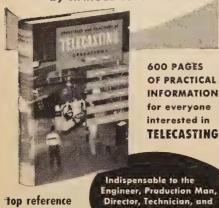
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In sending copies of this consumer booklet to all dealer and service organizations, Mr. E. C. Cahill, president of the *RCA Service Company* said: "All far-sighted people in this industry are dedicated to the objective of keeping up the present high standards of the television service, so that we may be recognized not only for the part we play in bringing good service and enjoyment to the customers we serve but also as worth-

while members of the communities which we live."

The RCA Service Company or line is not only very modest but itself a very fine tribute to mem of the independent TV service ternity.

These booklets are available service businesses at the RCA Sice Company's cost of 3c per book They are known as Form 2244 may be obtained through R. L. A. & Co. Inc., 809 Chestnut Street, Pl delphia 7, Pa.

-30-

MEET "OLD TIMER" ANTHONY HAGEN

By C. HOWARD BOWERS

WE ARE interested in finding out what has become of all the old time wireless operators — those who started about 1912. We are attempting to develop this information through this column, and we hope it will prove interesting to radiomen of lesser years' experience. If you qualify as an "Old Timer," write us care of this column.

In this issue we scan the career of ANTHONY HAGEN, 1416 Stickney Avenue, South St. Paul, Minn. Mr. Hagen's first experience as a commercial wireless operator was in 1911 at Isle Royale, Michigan, for the old Marconi Wireless Company of The Great Lakes, and later as a night operator at Duluth, Minn. Taking to water, "Tony" subsequently shipped out as operator aboard the "SS American," then in succession the steamers "Lakeland," "Tionesta," and various ore vessels. Mr. Hagen says his equipment consisted of both 2 kw. and 5 kw. transmitters, with plain and rotary spark gaps, together with old type Leyden jar condensers. Receivers were the slidertype tuning coils with carborundum and silicon crystal detectors. This equipment was remarkable for its inefficiency and,

quoting Mr. Hagen, "The receivers so insensitive that QRM from flock sea gulls was eliminated by wrappitowel around one's head, over the phones, thereby causing remarks the passengers as to what we had dutte night before!"

Shore duty about 1912-1913 paid subject Wireless Man the munificent ary of \$75.00 per month, seven per week, while shipboard duty \$48.00 per month, board and room cluded.

In 1917, Mr. Hagen enlisted for rice in World War I and acted as constructor. After that tour, he enbusiness for himself but later accommodate with the Pullman Commas an electrician, where he is today

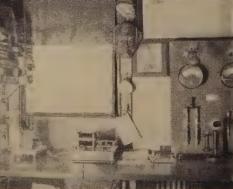
as an electrician, where he is today; "Tony" Hagen is now middle "But I can still remember," he; "when the 'Wireless Age' magazin fered \$5.00 for original crystal set I, ups in 1913 and, yet today in RAB TELEVISION NEWS comes an off. \$10,000.00 in prizes for crystal luns, only they call them transistory.

ups, only they call them transistors
We doubt if Mr. Hagen still f
old style wireless.

"Tony" Hagen as he looks today (left) and as he looked at the beginning of his cc reer forty years ago. (Below) The old Marconi Wireless station at Duluth, Minn







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Novice Receiver

(Continued from page 47)

makes it almost as easy as a twoterminal coil. For example, taking the 80-meter coil with its 21½-turn, center-tapped coil, start with two pieces of wire about three feet long. Twist two inches or so of these wires together and put them through the proper hole in the coil form and solder them into the pin at the bottom of the form. Now wind one piece of wire towards the top end of the coil form, run it through its proper hole and solder it to its pin, then wind the other piece of wire in the opposite direction down on the coil form to its hole and solder it to its pin connection. The fractional turn counts given in the coil data are caused by the fact that the holes for the wires are drilled above the appropriate pins on the coil forms. These pin numbers are shown at the ends of the coils in the schematic diagram. The spacing between the primary and the tickler coils is about one-quarter inch in the case of both the 80- and 40-meter coils and the tickler is wound on the lower end of the coil form. Be sure to wind the primary and the tickler (the small coil) in the same direction.

Naturally the enamel insulation will have to be removed from the ends of the wires before they are soldered. It will help considerably in soldering the coil wires into their pins to "tin" them lightly before inserting them, by giving them a thin coat of solder. The builder will notice that the wire ends and terminals of the various parts, such as resistors, condensers, etc. have already been tinned

by the manufacturer. The coil need not be scraped or tinned much more than half an inch.

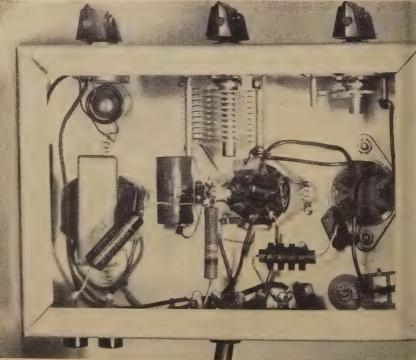
The two tuning condensers and regeneration control are mounted the front edge of the chassis and phone tip jacks and power cord brought out through the rear and plate load resistor and bloc condenser are used in the outstage to keep d.c. off the headplewires.

When the wiring is completed checked for correctness, you are r to try the receiver. After a more or so of warmup, turning the rege ation control clockwise should cau "plopping" sound in the headph This plopping sound occurs at point where the detector breaks: oscillation. On the clockwise sic this point, there should be a s rushing sound in the headset while the counter-clockwise side them only silence. Voice reception achieved with the regeneration trol set just short of the regener: point while code is received with control turned over into the regg ative state.

Almost any length of wire male satisfactory receiving antenna, proably one over 30 feet long. The wire you use for transmitting man excellent antenna for the receif you provide a single-pole, dot throw switch to change the antenna from transmitter to receiver destandby periods.

With a simple receiver of this and a long receiving antenna, the a possibility of cross-modulation you live near a strong broadcast tion or other powerful transmic Cross-modulation causes the bacast program to be heard in the a

Under-chassis view of the Novice station receiver. The audio transformer is see at left, below the regeneration control. Phone tip jacks and power cable can a seen along rear edge of chassis. Coil socket is at extreme right. Note roomy layer



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mbines functions of equalized preplifier plus adjustable record comisation, program input selection, 'e controls and volume control. ttching unit for the "Custom isic" amplifier. Self-powered for with any installation.

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tractive corner or wall cabinet in nd-rubbed blond or mahogany neers, "Distributed port" design ovides full low frequency response. and range with G-E Coaxial eaker—40 to 15,000 cycles.



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ground along with the desired sig even though the receiver is tuned a frequency far removed from broadcast station's. To eliminate effect, decrease the capacity in antenna trimmer condenser. This denser also helps take out any "d spots" in the tuning range caused antenna resonance effects. The ceiver tunes through the range 3.5 18 megacycles with the two coils scribed in the parts list. Other c could be suitably proportioned to tend the range if desired. The Nov can learn much by experiment with other coils wound with the of the inductance-capacity charts other data found in the various ra handbooks.

UNUSUAL SERVICE CALL

By JAMES B. TAYLOR

THE phone rang and the voice on other end of the line asked, "Can send a serviceman out to check my vision set? The last commercial the station ran over an hour ago is: on the screen."

"What?" I asked, "do you mean the station is running one commen

for over an hour?"
"Oh no," replied the voice on other end, "but when they ran as tage-cheese ad about an hour age must have been awfully strong for stuck to my picture-tube screen ustayed there. I can still see the c programs through the ad, but they

Muttering to myself that somebot either drunk or crazy, I picked up service kit and headed for the add given. What I saw can be seen in accompanying photograph. There the cottage-cheese ad as clear as would want on the screen in black,: the set still working and getting a ture, except for the black portions ing masked by the ad. The only the set owner could give was that heard a dull thud when it happene

EDITOR'S NOTE: Such an effects be due to ion acceleration in the and the resultant bombardment of screen by heavy ions. Where there large accumulation of electrons on screen (light portions of the pick there will be a great attraction fo ions, and this portion of the screen receive heavy bombardment resultit a burn on the screen. Darker pon of the picture will be burned-in less lighter portions. reversal effect. Hence, the pip

TV picture tube with commercial burn onto screen due to ion bombardm:



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signs are plain as to the future of the trained men in the electronics try. It is a tremendous industry, and—at the present time there are more han there are trained men to fill them. But—when there's a choice between ned and untrained applicant, the trained man will get the job. Your st problem is to decide on—and begin the best possible training program.

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good-paying positions with America's most important companies. Many famous organizations have arranged CREI group training for their radio-electronics-television personnel. To name a few: All America Cables and Radio, Inc.; Canadian Aviation Electronics, Ltd.: Canadian Broadcasting Corporation; Columbia Broadcasting System; Canadian Marconi Company; Hoffman Radio Corporation; Machlett Laboratories; Glenn L. Martin Company; Magnavox Company; Pan American Airways, Atlantic Division; Radio Corporation of America, RCA Victor Division; Technical Appliance Corporation; Trans-Canada Air Lines; United Air Lines. Their choice for training of their own personnel is a good cue for your choice of a school.



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copy. The rest—your future—is up to you.

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MAKE YOUR ELECTRONIFLASH MORE VERSATIL

By E. Q. PROCTOR

Simple circuit changes, incorporating a means of varying t light intensity, will make your flash equipment more uses

"THE greatest light output per dollar" is the rule generally followed by the prospective purchaser or constructor of electronic flash equipment. Frankly, this rule is hard to beat if the unit is to be used for general purpose shooting; the slow speed of color films and those long shots in black and white make it mandatory. On the other hand, this high light intensity can be something of a disadvantage under certain circumstances.

A large percentage of the flash equipment that is bought or built by the average amateur has only one flash bulb which is usually mounted on the camera. Used in this manner, the photographer may find that he has too much light for shots under eight or ten feet. As an example, a typical 60 to 100 watt-second unit will have a light output sufficient to give an exposure guide number in the vicinity of 160 with a certain film. This means that at 10 feet, the camera lens aperture should be set at f16; at 7 feet, f22; at 5 feet, f32; and at $3\frac{1}{2}$ feet, f45. Trouble arises at these distances if the camera lens aperture can not be reduced beyond f16 or f22 because there aren't any markings beyond that point.

Actually, very few miniature camera lenses have markings beyond f22, the markings on press-type camera lenses usually stop at f32, and f45 is generally found only on long focal length portrait and view camera lenses. As a result, the average amateur photographer, attempting to take a close-up of "little Peggy" to send to her doting grandparents, may find that he has to resort to undesirable gadgets such as a filter over the lens, a hand-kerchief hung over the flash tube, or some other means to reduce the effect of that brilliant flash of light.

The obvious solution to this problem is to have a means whereby the light intensity may be varied to suit the needs of different lighting requirements. While a few manufacturers have this feature incorporated in one or two of their models, I do not recall having seen it presented in an article on constructing flash equipment. I constructed a single flash unit several years ago with variable light output included in the design, and the variability has been a very useful innovation.

The principle of the variable fe is quite simple, and so is its const tion: With a given operating volthe light output of a flash unit i termined by the capacity of the age condensers used; that is, the capacity, the more light output : the power limit imposed by the tube. Therefore, in units that em more than one storage condense: light output can be varied by r of a switching arrangement which lows all or just part of the conde to be switched into the circuit. exact switching arrangement 1 used will depend largely on the ber of condensers employed and best be determined by the needs user. Preferably, it should be inco in a unit's design before construy however, it may readily be porated in existing equipment that more than one condenser and in 1 space for the switch is available

In the case of a unit that has two condensers, such as the ors scribed in the March 1953 issa RADIO & TELEVISION NEWS, all t needed is a s.p.s.t. toggle switch nected in a lead of either of the age condensers. With the switch both condensers will be in the ci with the switch off, one condenses be removed from the circuit, and power to the flash tube will be half. Toggle switches can be us this manner for any number o densers if a suitable rotary type available. My unit uses four densers, and I found, after corr able searching, that one of the type electric range switches with positions-high, medium, low, and filled the bill perfectly. In the position, one condenser is cons permanently in the circuit, and succeeding step adds one more.

My experience has shown this guide number varies directly with amount of capacity used. My ure a 2000-volt power supply and use 8 μ fd. oil-filled condensers which a maximum 64 watt-seconds of Using film with an ASA rating and with all four condensers swith the circuit, a guide number gives very good results with 1 mended film development. By only three of the four condenses guide number is reduced to 120

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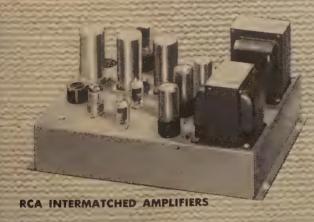
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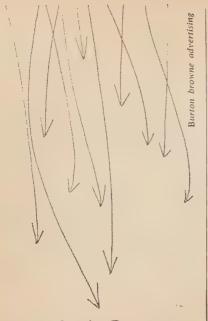
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ctober, 1953



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half the condensers in use, the guide number of 160 is halved; and with one condenser, the number is 40. This wide variation in available light has many possibilities including not having to stop the lens down when great depth of field is undesirable, not having the flash "swamp" the main light when using it as a fill-in light, etc.

Care should be used in selecting the switches to be certain that they will handle the high momentary current surges and that their insulation will not break down under the voltage employed. When my unit was under construction, I had on hand a 3-gang ceramic bandswitch; and with some misgivings, I connected it in the circuit. After a little use, my doubts were confirmed: the contacts on such a switch just couldn't take the heavy current surges and the arcing involved in switching uncharged condensers into the circuit. Spring-loaded switches that make contact quickly and positively are the best types to use. Otherwise, slow making and breaking will result in arcing between contacts and will shorten the life of the switch.

As a precaution against breakdown, switch contacts should be connected in the condenser lead that would normally be connected to the grounded side of the power supply. The shafts and toggle handles of the switches should also be grounded to the chassis in such a way that, should a breakdown occur, the high voltage can not reach the

In any unit having switches included as described, all condensers should be connected into the circuit before the power is turned off to allow the condensers to be discharged in a normal manner through the unit's bleeder -30-

International Short-Wave

(Continued from page 82)

Burma-Rangoon, 4.750A, becomes audible in Australia 1000 and closes 1020. (Williams)

Canada - Reports for the CBC should be addressed to Box 6,000, Montreal, Quebec, Canada. (WRH, others) VED, 7.32, Edmonton, Alta., noted recently 1830 with classical music, fair level but bad QRM. (Bellington, N.Y.) CHNX, 6.130, Halifax, N. S., has "Hobby Program" Thur. 1530-1545. (Grace, Conn.)

Ceylon-Radio Ceylon's Commercial Service sent letter-veri for 11.975 and listed India beam in English 2030-2330, 15.120, 9.520; 0730-1230, 11.975, 9.520; in Hindi 2030-2300, 0830-1130, 7.190. (Pearce, England) Heard on 6.006 at 0730 with music, commercials. (Sanderson, Australia)

Chile — CE1515, 15.15, Santiago, noted in Spanish 2100.

China-Radio Peking is seldom audible for English session 0830 on 15.06, 11.69A, but the Home Service is good then on 10.20, 10.26, 9.04, 7.50. 6.20. (Balbi, Calif.)

Colombia—The new Colombian on

PHILCO TV TURRET TUNER (Pt#76-3109, lass contact strips). For '48 & '49 models ..., \$1.4 pHILCO TUNER with 3 socket wired RF strip. 19.1 pHILCO 3 MIN. SOCKET RF STRIP containing over \$4.00 worth of resistors, cond., etc. ..., 1/17 H.P. G-E NOTOR (Type SD)—17.25 RPM, 7 amb. Dble 3%' shaft, 110 VDC. 434'x51/g". 3.5 mm. Dble 3%' shaft, 110 VDC. 434'x51/g". 3.5 mm. Dble 3%' shaft, 110 VDC. 434'x51/g". 3.5 pHILLE RADIO-AMPLIFIER STEEL CABINET (14"x8"y8" deep. Exc. also for Test, Medical or Industrial Eart. Includes hinged front cover, 2.4 phille 20 phille 19.1 phille 1

19 FT. WHIP ANTENNAS 6 steel screw sects. \$ 3.25W-250 Ohm POTENTIOMETER (Claro).

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PIONEER AND OUTSTANDING PRODUCE OF FINEST LINE OF ANTENNA MOUNT identifies as "Radiofonica Coa;" opens around 0600; strong in Australia. (Cushen, N. Z.: Hut-Australia)

(ta Rica—Radio Crystal, TIHBG. San Jose, sent letter-veri; listed Jule of 0745-2400. (Pearce, Eng-

ba-The Cuban which has been VLC9, 9.615, Australia, sings (EST) may be COJK, moved 8.663. (Stark, Texas)

prus-Sharq-al-Adna, 6.790, Lirol, noted 1255-1335 in Arabic; has in Arabic 1330. (Arvidsson, (en) Heard on 9.650 with call in ic 1115 followed by slow-speed in that language. (Pearce, Eng-

echoslovakia—OLR3A, 9.55, Pranoted in English to North Amer-(930-2000. (Zerosh, Pa.) And at \$\\2330\$, announcing "This is the e of Peace from Prague." (Mor-Pa). A letter from a station ofs says will be glad to answer reand questions during the "Anto Listeners" session 2300 Sat.; emusical half hour Sun. 2300-2330. d, Iowa) Heard on 9.504 with sish from 1400 sign-on. (Pearce, and) Uses this channel for Engnow 0715-0745. (ISWC, London)

*nmark---Copenhagen's OZF, 9.52 fl with DX session on Tue. around (Crowell, Pa.) And repeated A. (Ferguson, N. C.) Tests for inland on this channel noted daily 1-2000. (Boyce, N. J.)

minican Republic-HIIZ, 6.115A, ad Trujillo, is showing up with ig signal around 1830; at times "Emisora Nacional" as well as Voz de Muchachos." (Niblack, HI2T, 9.727A, noted 2125 with hish, fine level in Michigan. (Horn-

lutch New Guinea-Word from o Omroep Nieuw Guinea, Holia, indicates that the station will moved at the end of this year to x, one of the Schouten Islands, re a new studio and a 5 kw. transer will be put into service. Present Idule on 7.126 was listed 0430-0700 ly; Thur. 0400-0700; Sat. 0430-0730; there is a special transmission 1-2300, Sat. at 2100-2300; present er is 350 watts. (Scheiner, N. J.) rd lately in Australia on 5.045 at 0-0630 closedown. (Williams) Is allel with 7.126 and usually has is in Dutch 0500. (Cushen, N. Z.) cuador—By this time, transmitters HCJB, Quito, "The Voice of the es," should have been moved to where it is expected signals will

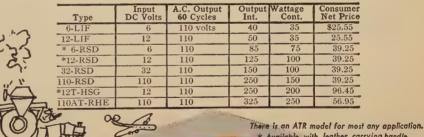
C1BF, 4.750, Radio Commercial, to, noted with dance music, Spanidentification 2200 to 2300 sign-off; level. HC1FM, 6.830, Radio Equicial, Ibarra, heard with dance mu-2200, weak, CWQRM. (Hardwick,

nuch improved. Wants reports.

gypt—Cairo has been testing one its *new*, powerful transmitters bably 100 kw.) on 9.615, heard (Continued on page 134)



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Professional model. Sands old finishes from wood or metal, or and polishes to a "plano finish." Takes any grade of sandpaper or al 3/16" orbital motion 110-120 V. 60 cv. air cooled AC 3450 r.p.m. direct driven. Cast aluminum body—all sealed ball bearing const. Lightwelzhi—only 5 lbs, complete.



SPEED WAY BENCH GRING

REG.

STOCK NO.

110-120 Volt 60 Cycle AC (Only) 3400 R.P.M.; 4½" x 3½" s and coarse wheels; self-aligning bronze bearings; U.L. Approv balanced-smooth and silent running—no creeping. Lightweight Rubber feet prevent scratches or may be bolted to bench. Strocast aluminum housing with wheel guards and tool rests. Handso finish—a must for every home or shop and a fabulous buy at 0 price. Stpg. wt. 8 lbs.

USE HANDY ORDER BLANK ON NEXT PAGE

OLSON RADIO WAREHOUSE

275-F EAST MARKET ST., AKRON 8, OH

AILYOUR ORDER TODAY—OLSON WILL RUSH IT RIGHT AWAY!

BE CUSTOM AUTO RADIOS

our chance to save plenty on these nationally JUSTOM AUTO RADIOS. Simple to installed, no brackets, no holes to drill. Install in 3 utes. Custom-built to fit in dash of each model I. Six tubes including rectifier-2 being dual-thus you really get 6-tube performance. Dynamic of the property of the prope





CHOICE OF ANY MODEL

STK. NO.	MAKE OF CAR	YEAR MODEL
RA-144	Ford	1953
RA-451	Hudson	'48-49-50-51-52-53
RA-751	Henry J.	1951-52
RA-143	Mercury	1952-53
RA-200	Plymouth	1949-1950
RA-651	Plymouth	1951-52
RA-125	Plymouth	1953
RA-551	Studebaker	1950-1951-1952

MPLETE TV ANTENNA

um. Reg. list



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FINAL CLOSEOUT! THYRATRON CONTROLS



PERMEABILITY TUNED AM FRONT END 3 for S5.50 BRAND NEW! PARTS ALONE WORTH \$4.50. Used in standard broadcast receivers in place of variable condenser and associated parts,

RCA TV LINE COUPLER

Made by RCA and used on their production lines.

3-SPEED AUTOMATIC PORTABLE RECORD PLAYER

Complete With Latest Model VM Changer, Amplifier, Speaker and Portable Carrying Case.

Made by RCA.

And used on their
production lines.

RA-145
Copper Case 3½,
x 3½, x 2², fully
th built-in deck and remov22 amplenol silver plated
ty:1—RCA. 5l5 tube, socket
3—Imfd. 400 volt tubular
2 mica condensers; 5 reder, choke and slug tuned
wt. 3 lbs.

RA-145
Copper Case 3½,
rd. 45 PPM); twelve 10²
rd. silver plated
ty:1—RCA. 5l5 tube, socket
3—Imfd. 400 volt tubular
2 mica condensers; 5 reder, choke and slug tuned
wt. 3 lbs.

RA-145
Copper Case 3½,
rd. 48 PPM); 100% automatic in operation. Just stack on the records. Motor shuts off after last disc.
Volume and tone controls. Simulated Alligator case 17 x 100.

Wt. 3 lbs.

RA-145
Copper Case 3½,
rd. 45 PPM); twelve 10²
rd. 5 RPM); 100% automatic in operation. Just stack on the records. Motor shuts off after last disc.
Volume and tone controls. Simulated Alligator case 17 x 100.
Wt. 3 lbs.

BRAND NEW

ALL-METAL PARTS CHESTS

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ON'S BIG NEW

48 DRAWERS 22½ "High, 12½ "Wide 6" Deep 144 COMPARTMENTS

Olson gives you a chance to load up on these famous make Parts Chests for less than HALF THEIR REGULAR PRICE. Case is heavy, welded Dura-Steel, strong and sturdy with handsome grey enamel finish. Drawers are ALL-ALU-MINUM—1½" deep, 2½" vide, 5½" fong, Each drawer has 2 removable sliding partitions. Index cards provided for insertion in card holder on front of each drawer. Order your share while they last. Keep all those small things handy—such as Nuts, Bolts, Screws, Small Parts, Condensers, Resistors, etc. Chests may be assorted for quantity price. Shpg. wt. X-334, 9 lbs.; X-335, 18 lbs.





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ONLY WILCOX-GAY Recordio TAPE RECORDER with PREST-O-MATIC push-button keyboard gives Maximum performance for Lowest cost! STOCK NO. AMP-17

DUAL SPEED—Records at 1 1/8" and 3 3/4" per second

Records for 2 hours on half of a 7" reel plus another 2 hours on other half at 17/6" per second; and at the 33/4" per second speed you can record a full hour on each half of a seven-inch reel. 80-6000 CPS.

this is the famous DeLuxe Wilcox-Gay Recorder that retails all over the country for \$159.95. faturally they are all brand new, in factory called cartons and Guaranteed 100% by Wilcoxay and Olson.

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e answer is simple . . . our main purpose in is business is to offer the highest quality for vest cost . . and the Recordio is a perfect ample.

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Record those treasured "Family Highlights"...
or your favorite music, broadcasts, friends or
parties. Use it in your business for dictation,
meetings, speeches, etc. Portable Recordio is
also a valuable aid in Schools, Churches, and

INSTANTANEOUS RECORDING OR PLAYBACK.
2-SPEEDS, RECORDS, PLAYS BACK, ERASES,
LOOK AT THESE QUALITY-PACKED FEATURES.
CHOICE OF A CONTROL OF THE PROPERTY OF THE

BRAND NEW PLASTIC BASE RECORDING TAPE

BASE RECOK.

800 Ft. REEL

STOCK NO.

X-275
Single, ea.

Lets of 10

Stock No.

X-249
Single, ea.

Lets of 10

Stock No.

X-249
Single, ea.

Lets of 10

Stock No.

X-249
Single, ea.

Stock No.

X-249
Single, ea.

Stock CON.

No.

TACTS
SOHMS
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6 to 12 V.

We're letting the SW-30
SW-29
Plate Sens.

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Plate Sen



\$199



4-PIECE PLIERS and WRENCH SET

Handlest of all Kits for the repairman and hobbyist-lowest price ever. Set includes 7" Linesman's 5-3/16" Long Nose Pliers, 5-3/16" Diagonal Cutte 6" Adjustable Wrench. These quality tools are m finest drop forged steel with ground and polished Cutting blades carefully hardened and tempered to keen, sharp edge. Complete with plastic pouch wit lets for hanging and See-thru pockets for tools. Shg 2 lbs.

PRICES SLASHED TO BITS ON OLSON RESISTOR KITS GIANT "SUPER-ASSORTMENT" KIT-232 RESISTORS





IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. State quantity desired, stock number, description and price. You may send remittance with order. (Add for Postage: Estimate at least 5c for each \$1.00 of order value,—10c for each \$1.00 if you are more than 1,000 miles away. We refund every cent not used) or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MAIL TO: 275-FE. MARKET ST., AKRON 8, OHIO WE SHIP SAME DAY WE GET YOUR ORDER

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Everything you order from
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more than satisfied, you may
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Here's the new SIII

All-Purpose Crystal MICROPHONE



LIGHT! The new "777" Slim-X Microphones are rugged little microphones weighing only 6 ounces! They are designed for good-quality voice and music reproduction. Their versatility and "hand-a-bility" make them ideal for use by lecturers, announcers, instructors, and Hams; for audience participation shows; carnivals; panel and quiz shows; and use with home-recorders. When mounted on either cradle or swivel, the "777" can be removed in a flash (no tools necessary)—simply by lifting it out of the holder. This makes it an ideal "walk-around" hand-held microphone.

TECHNICAL INFORMATION: Smooth frequency response—60 to 10,000 c.p.s.; special-sealed crystal element-for long operating life; high impedance; 7 single-conductor cable, disconnect type. Dimensions: (Microphone only) Length, 41/2"; Diameter 1". Finish: Rich satin chrome overall.

NOTE: Lavalier cord for suspension of Microphone around neck is included.

ACCESSORIES FOR "777"

MODEL S38 STAND is a heavy die-cast base. Includes metal screw machine stud for connecting microphone adaptor to stand base.

List Price: \$3.30

MODEL A25 SWIVEL ADAPTOR features a long-life, high-quality swivel connector. Is lined with a long-life nylon sleeve—for noise-free and scratch-free insertion and removal of microphone.



SHURE BROTHERS, Inc.

MICROPHONES and ACOUSTIC DEVICES 225 W. Huron St., Chicago 10, III., Cable: SHUREMICRO

NEW TV STATIONS ON THE AIR

(As of September 25, 1953)

The following new stations bring the lists published in previous issues up to date.

STATE, CITY	STATION	CHANNEL	FREQUENCY RANGE (IN MC.)	VIDEO WAVELENGTH (IN FT.)	VIDEO POWER (IN KW
Florida				E 01	20.5
Panama City	WJDM-TV	7	174-180	5.61	10.5
Pensacola	WPFA-TV	15	476-482	2.06	21
West Palm Beach	WIRK-TV	21	512-518	1.92	24
Kentucky				* 00	000
Louisville	WKLO-TV	21	512-518	1.92	230
Maine					00
Portland	WPMT	53	704-710	1.4	22
Massachusetts				1.00	0
Cambridge	WTAO-TV	56	722-728	1.36	21.5
Michigan					
Battle Creek	WBCK-TV	58	734-740	1.34	20.5
Lansing	WILS-TV	54	710-716	, 1.38	25.5
Missouri					
Kansas City	KMBC-TV1	9	186-192	5.25	30
Kansas City	WHB-TV1	9	186-192	5.25	30
Montana					
Butte	KOPR-TV	4	66-72	14.6	18
Butte	KXLF-TV	6	82-88	11.8	2
New York					
Buffalo	WBES-TV	59	740-746	1.33	. 21.4
Ohio					
Dayton	WIFE	22	518-524	1.9	254
Oklaĥoma					
Oklahoma City	KLPR-TV	19	500-506	1.96	260
Pennsylvania				3.00	000
Wilkes-Barre	WILK-TV	34	590-596	1.67	250
South Carolina					00.7
Columbia	WNOK-TV	67	788-794	1.25	93.5
Texas					-
Houston	KNUZ-TV	39	620-626	1.58	89
Longview	KTVE	32	578-584	1.7	20
Waco	KANG-TV	34	590-596	1.67	5
Virginia			**		
Harrisonburg	WSVA-TV	3	60-66	16.06	100
West Virginia					
Charleston	WKNA-TV	49	680-686	1.44	221
Wisconsin					
Milwaukee	WOKY-TV	19	500-506	1.96	240

*From Station CP application. ¹Share time on air. The frequency of thì video carrier = 1.25 + channel lower freq. limit. Total number of television stations now on the air: 261 (84 of which are u.h.f.

A TRANSISTOR BRIDGE NULL DETECTOR

By LOUIS D. CARCANO

MPEDANCE bridges and capacitance bridges which employ headphones for null detectors, offer good opportunity for transistorization. A visual null indicator is more convenient than a pair of "cans." Null detector circuits using vacuum tubes, however, are inconvenient because of long warm-up time, and require a separate power supply.

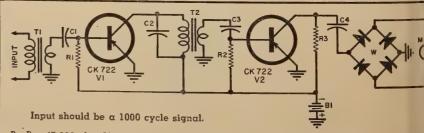
The transistor circuit shown requires no waiting after it is turned on and takes all its power from the 6-volt battery usually included in the impedance bridge.

The circuit consists of two groundedemitter stages using junction transistors, and a rectifier and a microammeter. Sensitivity is not quite as great as with headphones, but was found to be adequate.

The input impedance is about 20.0 ohms. Ordinary midget output tri formers make satisfactory intersr coupling units. Transformer T₂ is tel to 1000 cycles with a condenser C2. value of C₂ will vary with the partici model of transformer, but should around .002 to .005 μ fd.

The second stage should overload before the meter goes off scale. (load level depends on the emitter current, which is determined by res R_2 for any particular battery volte R_2 may require adjustment for the R_2 ticular transistor used. A more sensi microammeter can be used if R₂ is creased accordingly.

Circuit of a bridge null detector which uses two CK722 "p-n-p" junction transistors.



 R_1 , R_2 —47,000 ohm, $\frac{1}{2}$ w. res. (see text) R_8 —4700 ohm, $\frac{1}{2}$ w. res. C1, C8-.5 µfd., 200 v. cond.

 C_2 —See text C_4 —.25 μ fd., 200 ν . cond. T_1 , T_2 —Output trans., 1500 ohms to 3 ohms

W-Bridge instrument rectifier or four & manium diodes connected in bridge circuit M₁—0-500 microampere meter

 B_1 —6 volt battery V_1 , V_2 —CK722 "p-n-p" junction transis (Raytheon)

BUY DIRECT AND SAVE

Sweeping the Country!

UNERS 'PRE-FAR' RECEIVERS

AUDIO PRODUCTS CO.

s Audio Products Co. is in no way Filiated with Collins Radio Co.

Two ALL NEW Complete Kits for Every High-Fidelity Need



e FM-11 tuner is available in kit form with If Amplifier mounted in the chassis, wired d tested by us. You mount the completed Tuning Unit and power supply, then after me simple wiring, it's all set to operate. tubes: 6J6 RF amp, 6AG5 converter, 6C4 cillator, 68A6 1st IF, (2) 6AU6 2nd and 3rd (2) 6AU6 limiters, 6AL5 discriminator, ALT-GT double tuning eye, 5Y3-GT rectifier. ensitivity 6 to 10 microvolts, less than ½ of a distortion, 20 to 20,000 cycle response ith 2DB variation. Chassis dimensions: 12½" ide, 6" deep, 7" high: Illustrated monual polied. Shipping weight 14 lbs.

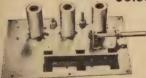
Each Collins Tuner Kit is complete with punched chassis, tubes, power transformer, power supply components, hardware, dial assembly. tuning eye, knobs, wire, etc., as well as the completed sub-assemblies: FM tuning units, AM tuning units, IF amplifiers, etc., where applicable. Since all these sub-assemblies are wired, tested and aligned at the factory, Collins Pre-Fab Kits are easily assembled even without technical knowledge. The end result is a fine, high quality, high fidelity instrument at often less than half the cost — because you helped make it and bought it direct from the factory. Bring your present reproducing system up to date with a new Collins Tuner



FM/AM Tuner Kit

The original 15 tube deluxe FM/AM pre-fab kit redesigned on a smaller chassis. The tuner now measures 14" wide by 12" deep by 71/2" high. This attractive new front and dial assembly opens up new applications where space is at a premium. Kit includes everything necessary to put it into operation-punched chassis, tubes, wired and aligned components, power supply, hardware, etc. Kit comprises FMF-3 tuning unit, IF-6 amplifier, AM-4 AM tuning unit, magic eye assembly and complete instructions. All tubes included. Shipping weight 19 lbs.

Selected Basic Components For Special Applications



FMF-3 Tuning Unit

\$1525

IF-6 Amplifier



AM-4 Tuning Unit

COURON

The best for FM. The most sensitive and most selective type of "front end" on the market. 6 to 10 microvolts sensitivity. Image ratio 500 to 1. 6J6 tuned RF stage, 6AG5 converter, 6C4 oscillator. Permeability tuned, stable and drift-free. Chassis plate measures 6½"x4½" In combination with the IF-6 amplifier, the highest order of sensitivity on FM can be attained. Tubes included as well as schematic and instructions. Draws 30 ma. Shipping weight FMF-3: 2½ lbs. Dial available @ \$3.85

A remarkable value! 6 tubes are used in the IF amplifier: 6BA6 1st IF, (2) 6AU6 2nd and 3rd 1F's, (2) 6AU6 limiters and 6AL5 discriminator. High gain, wide-band response (200 KC) for highest fidelity. 20 to 20,000 cycles. Distortion less than 1/2 of 1%. Draws 40 ma 220 volts. Chassis plate dimensions: 11-5/16"x21/2" Shipping weight: 3 lbs.

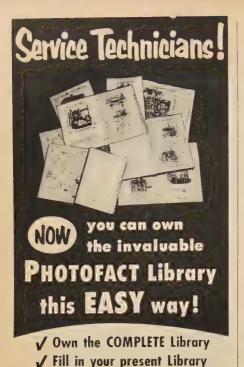
Tops in AM superhet performance! A 3-gang Tops in AM superhet performance! A 3-gang tuning condenser gives 3 tuned stages with high sensitivity and selectivity. Assembly is completely wired, tested and aligned ready for immediate use. Frequency coverage 540 KC to 1650 KC at a sensitivity of 5 microvolts. Tubes 6BA6 RF amplifier and 6AT6 detector. Draws 30 ma @ 220 volts. Mounts on a chassis plate measuring 4"X736". Shipping weight 2½ lbs. Dial available at \$3.85. ping weight 2 able at \$3.85. MAIL



The COLLINS RD-IC FM tuner chassis is unique in the field. A whole, compact FM tuner and dial that fits in the palm of your hand. Convert AM sets to FM/AM receivers for only a few dollars! Unlimited applications where space is at a premium. Use in conjunction with your phonograph amplifier. Full frequency response to 20,000 cycles. Sensitivity 20 microvolts, permeability tuned. Tuning unit and IF amplifier on the same chassis plate. Draws 40 ma @ 100 volts. Tubes: 6AG5 converter, 6C4 oscillator, (2) 6AU6 IF amplifiers, 6AL5 in new ratio detector circuit Shipping weight tuner and dial 5 lbs

To: Collins Audio Products C P.O. Box 368, Westfield, N. Tel. WEstfield 2-4390		TODAY
☐ FM Tuner Kit ☐ FM/AM ☐ FMF-3 Tuning Unit ☐ IF-☐ AM-4 Tuning Unit		
NAME		
ADDRESS		
CITY	STATE	
Amount for Kit \$ See	weights, add ship	ping cost \$
1 Tatal amount analoged \$	Check □	Money Order

THINK OF TUNERS, THINK OF COLLINS AUDIO PRODUCTS



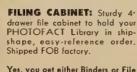
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International Short-Wave

(Continued from page 129)

1215-1630 to Europe with calls in English, French every quarter-hour, followed by a tone of 1000 cycles; reports requested. (RadioSweden, WRH, others) The 11.815 outlet which carries mostly English, French seems to close daily now 1700, but the Arabic session on 11.965A, 6.085, in parallel, runs later. (Pearce, England, others)

El Salvador-YSS, 9.55A, Radio Nacional, San Salvador, noted with uninterrupted classical music 2235 to identification at 2300 closedown. (Pow-

England—To observe its 25th anniversary, the BBC is now conducting a contest among listeners, to determine what programs have been enjoyed

most. (Bellington, N. Y.)

The Standard Frequency Station, MSF, Rugby, appears to be using 2.500, 5.000, 10.000 continuously 24 hours a day now. Callsign in slow Morse code and speech announcements are given at the 14th minute of each quarterhour; reports are requested to the National Physical Laboratory, Teddington, Middlesex, England. (Patrick, Catch, Pearce, England; others)

Fiji Islands-ZJV, Suva, is noted daily around 0300 on announced 3.980; closes 0500; signal usually poor in Australia, (Williams) Lately noted back on 5.980A parallel 3.980. (Hardwick, N. Z.) Heard on this channel by Saylor, Va., 0100-0400 fade-out, with news 0215. Cain, Nevada, received ZVJ (m.w.) card verifying tests over 6.005 some time ago; had picture of native on card; asked for more reports.

France-Paris has English for Britain 0145-0200 on 7.240; 1500-1600 on 6.045A. (Catch, England) Mail Bag session on Wed.

French Morocco — Radio Maroc, 7.220, Rabat, noted at weak level opening 0700; good level when returned 0800, French news. (Pearce, England) This transmission closes 0900A; is listed with news in Spanish 0700.

Germany - Cologne, 11.795, noted with call and announcements in Spanish, German 1655 in transmission to Latin America; at 1703 news in German; good level. (Mosquita e Sousa, Portugal) Noted on this channel 2330 closing transmission to North America with English announcement; slight CWQRM, fair level. (Christie, Calif.) Although not announced, 5.98 parallels in this transmission 2030-2330A. (Bellington, N. Y.)

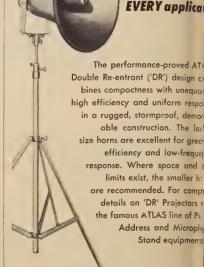
Greece — Central Forces Station, Athens, has returned to 7.420A and is heard 2325-0105; news in Greek 0027; CWQRM from 0005. (Arvidsson, Sweden) Is heard in Virginia sometimes around 2350-0200 fade-out. (Saylor) Larissa, 6.752, noted at good level around 1416 with music. (Lorentzson, Sweden)

Guadeloupe-FG8HA, 9.423AV, Basse-Terre, varies considerably; noted as

ATLAS PROJECTO

9 models to

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TUBES! ONE FULL YEAR TUBE GUARANTEE

Туре	Price	Type	Price	Type
OB3 /VR90 .5	. 75	6BD6	.45	12AL5
1A5GT	.46	6BE6	.39	12AT6
1A6	.59	6BF5	.41	12AT7
1A7GT	.47	6BF6	37	12AU6
1AB5	.59	6BG6G		12AU7
1B3	.65	6BH6	.46	12AV6
185 187GT	.59	6BJ6		
1B7GT	.59	6BK7	.59	12AX4
187GT 1C5GT 1E7	.43	6BL7	.59	12AX7
1H4G	.29	68Q6GT	.65	12AZ7
1H4G 1H5GT	40	6BY5	.65	12BD6
1G6	.60	6BZ7	.90	128E6
1L4	.46	6C4	37	
1LC5	.51	6C5GT	.39	12BF6
1N5	.46	6CB6	.44	12J5GT .
1P5	.57	6CB6	1.29	12Q7G
1Q5	.58	6D6	.45	1258 125A7GT.
1R5	.45	6E5	.48	125A7GT.
155	.39	6F5GT	.39	12SG7GT.
1T4	.45	6F6	.37	125J7
1T5	.53	6G6G	.52	125K7GT.
104	.45	6H6GT	.41	125L7GT.
	.60	6D6 6E5 6F5GT 6F6 6G6G 6H6GT 6J5GT 6J6	.37	12507
1X2	.70	6K6GT	.37	125R7
2X2	1.50	6J7G	.43	
3A4	.45	6J8		14AF7
3E5	.46	6K5		14N7
304	.48	6K7	.44	19BG6G .
3Q5GT	.49	61.6	.63	1908
354	.46	6Q7	.45	1978
3V4	.47	654	.38	19V8
5U4G	.41	658	.53	25AV5
5V4	.73	6SA7GT	.43	25BQ6GT.
5X4	.40	65D7GT	.41	25L6
5W4	.50			25Z6GT
5Y3G 5Y3GT	.32	6SH7		25W4
5Y4G	.35	CCLTOT	.41	26
5Z3	.46	6SK7GT		27
6A3	.59	6SL7GT		35B5
6A7	.59	6SN7GT	.49	35C5
6A8	.62	6SQ7GT	.37	35L6GT .
6AB4	.44	6SR7GT	.60	35W4
6AG5	.43	6557 6T8	.60	35Z4
6AJ5	.70	6T8	.56	35 Z5GT .
6AK5	.72	6U4	.60	36
6AL5	.38	6U5	.44	

under \$10.00 add \$1.00 handling charge. Shis F.O.B. Irvington, N.J., and tubes subject to prib

HI-LITE ELECTRONIC SALES

837 18th Avenue

Irvington

sas 9.415, later back on 9.423AV; ked around 1939; heavy QRM. Mack, Ind.)

atemala—TGOQ, 9.705A, is heard 2315 without interference from 1, 9.700, Bulgaria. TG2, 6.618A, altenango, is good level as early 00 when identifies in Spanish as io Morse." TGNA, 9.668, 11.85, testing in English with anricements only 1130, 1215 recently. lent level. (Niblack, Ind.) Noted ng down on 9.668 in English 2345. vers, Ohio) TGWB, 6.182, good when closing 2400. (Cain, Neva-

iti—A strong signal is reported "Radio Commerce," testing at bus times on 9.485A in French. hish, English and perhaps other uages; has been heard around -1230 sign-off; around 1700-2300 off. By now is probably on regschedule of 0600A-2300. QRA is 94, Port-au-Prince, Haiti; wants rts. (West, Va., Grenell, Ohio; ngton, N. Y., others) Noted 1445 French. (Niblack, Ind.) ich news 2100. (Balbi, Calif.)

least on Thur., 4VRW, Radio i, 10.065A, Port-au-Prince, has an dish program ("Your Music Caraat 2130-2220; this one identifies English as well as French quite n now. (West, Va., others)

VEH, Cap Haitien, has received hission to go on the air in the 60band with 1 kw., and in the 49-m. with 5 kw., daytime hours only; uilding directional antennas. Latschedule is daily except Thur. 0600-Sun. 1630-1900 on 9.690; Sun. 1900-2140, 9.728. Plans a Mailbag gram soon for *English*-speaking rners. (West, Va.)

lolland - Radio Nederland, 6.025, d 1545 with announcement in nish. (Mesquita e Sousa, Portu-Heard on this channel in English Jorth America around 2200. (Crow-Pa.) Is good level in English 1645on 11.73. (Mullen, Mass.) Noted 9.59 after 1800 in Dutch. (Zerosh,

ionduras - Stark, Texas, lio Monserrat down to 6.019 from 0 with continued distortion; opens und 0730 and signs off 2300A.

fong-Kong - ZBW3, 9.525, noted 0, good level with music. (Sander-Australia) Lists current schedule Chinese-*English* as 2230-0000 Sun.-4, 0400-0930 daily, 1900-2300 Sat., D-2400 public holidays. (Scheiner, J.)

lungary—Radio Budapest, 9.833, ed with English 1945-2000, then ngarian. (Grace, Conn.) Has Engfor North America 1715-1745, 10-2000, 2300-2330, 11.91, 9.833, 7.22; lio Mailbag is Sun. (Smits, Minn.) ndia—AIR, 15.380, noted signing on glish for Southeast Asia 0830; said allel on 11.78; had news 0835; off

5. (Pearce, England)

ndo-China (Vietnam) — According word direct from Saigon, there will new s.w. transmitters and increases power soon. (Scheiner, N. J.) In



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verifying, Radio France-Asie, Saigon, listed English Europe 1100 on 11.950; 2030 on 11.935 to India; 0900 d 11.935 to Southeast Asia, India; 1830 on 7.230 to Far Ea and Southeast Asia; 0400 on 15.430 to Pacific. (A vidsson, Sweden) Radio Hirondelle, 7.410A, Hanoi note around 0515; starts to fade 0600. (Williams, Australia and others)

Ireland (Eire)—While vacationing in Ireland, Catc England, visited Radio Eireann where he learned that is not known when s.w. broadcasts will be resumed, though both a new 100 kw. transmitter and a 1.5 kw. o are available; the new 100 kw. transmitter is suitable f the 16-, 19-, 25-, or 31-m. band but has never been test-

although it is "warmed up" once a week.

Israel—Officials of the Israel Broadcasting Service i form Scheiner, N. J., that the new 50 kw. s.w. transmitted

should be on the air soon.

Japan—Far East Network, AFRS, Tokyo, sent QC card for 11.825, 9.605; listed JKL, 4.860, 0345-1000; 9.60 1815-0330; 4.860, 1600-1800, JKI, 11.825, 1815-0330, 6.00 1600-1800. (Pearce, England) Radio Japan, 15.135, not 0005 with news, fair level in Iowa. (Lund) And in Wass ington State. (Simmons) Noted in Japanese 0030-01 (Glover, Texas)

Italy-Rome 9.750, noted with news 2145 to Non

America. (Corson, Iowa)

Libya—Forces Broadcasting Station, 4.965, Tripq
noted 1531 with popular music; at 1600 closedown gettime as "11 p.m.," and said would return 2330 on 1486 3 and "experimentally on 4.965." Said "Goodnight to lister ers in Tripolitania and to short-wave listeners whereve they may be;" closed with "God Save the Queen." Fit merly used announced 4.782. Sent QSL card from No. Forces Broadcasting Station, Tripoli, M.E.L.F. 1; pov) listed 250 watts; transmitter is BC-610; antenna a dipo Confirmed move from 4.782 to 4.965 and asked for furth reports. (Pearce, England, others)

Mozambique—Current schedule received from Loure: Marques lists Portuguese 0000-0100, 0430-0630, 1045-1 on 11.815, 10 kw. 15.285, 10 kw., 4.829, 7.5 kw.; *Engl*) 2300-1300, 11.761, 7.5 kw.; 2300-1600, 4.916, 7.5 kw.; 01) 1000, 7.262, 7.5 kw.; 1100-1600, 3.490, 7.5 kw. (Scheiri The 4.916A channel noted at good level arou 2330-0100 fade-out. (Saylor, Va.; Scheiner, N. J.) Heie opening 0000 on 11.955. (Cushen, N. Z.) Heard well Sweden on that channel 1200 with news in Portugue

then music. (Lorentzson)

New Caledonia-Radio Noumea, F08AA, has been he back on 6.035 with talk in French 0350; fair signal, clear. (Balbi, Calif.) Noted opening there 0200. (William Australia) Heard by Fox, N. Z., and Sanderson, Austra over a second transmitter on 3.350 at fair level.

New Zealand—ZL9, 11.81, Wellington, noted arou 0000 with music. (Harder, Washington State)
Norway—Radio Norway, 9.610, Oslo, noted opening:
Western North America 2300 in Norwegian but also we English announcements. (Deskins, Calif.) Closes 24 (Neyland, Calif.) Good on this channel to Eastern No America 2000-2100. (Zerosh, Pa., others)

Pakistan—Radio Pakistan noted with news 1015-1on 9.484; with slow-speed news 1310-1330 on 7.010, 11.6 (Pearce, England) Heard widely to Turkey 1445-1530. Britain 1530-1615 closedown on 11.65 parallel 9.645. (Bo Conn.; Bellington, N. Y., others) Heard on 9.645 at 0 with Home Service of news, music. (Sanderson, Austral Heard 2015-2100 over 11.885, some English. (West, V And parallel on 15.335. (Cain, Nevada)

Paraguay-ZPA5, 11.95, has news in Spanish 1700; Qu

from Lisbon. (Lorentzson, Sweden)

Peru—OAX4T, 9.562, Lima, Radio Nacional del Penoted 2305-2315 with Spanish music, announcement (Morris, Pa.)

Philippines—Far East Broadcasting Co., Manila, heard well from 2300 onwards on its 17.805 outlet. (Huy ins, Australia) DZ17, 6.080, Manila, noted in English (relaying DZMB, (Williams, Australia) According to w from DYSR-DYH-4, a *new* 10 kw. transmitter is plan probably for use on 6.055; also plans to operate later in the tropical band on a frequency of 3.277 mc.;

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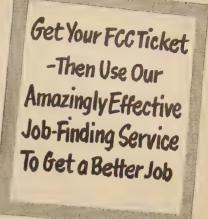




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present uses 6.055 with 1 kw., 6 with a BC-610. (Williams) D2 9.500, noted 0430 with English; Dz 9.640, heard with news, music arc 0415. (Sanderson, Australia)

Poland-Warsaw, 7.145A, noted English for USA around 2320-2 (Morris, Pa.) Heard closing Eng to North America 1800 on 11.74; p ably opens 1745. (Roberts, Co. Warsaw noted on 9.57 at 0930with special program called "Mi the Common Language of All ples;" announces this for Wed., only, and says is parallel on 42.13 (Pearce, England)

Saudi Arabia-Djeddah was tu recently near 7.095 at 1317 when interval signal, signed on 1323 march-anthem, call in native, usual man chanting without acc paniment; news in Arabic 1357A left air 1410. (Pearce, England) N on 11.95 at 2300 with Arabic prog of news, music. (Sanderson, Austra

Somali-Radio Somali lists frequency cy as 7.420 but is heard near now; scheduled 0445-0530, 1200-0 in Italian; 0915-1015, 1100-1200 Somali. (Pearce, England, others):

Spain-Madrid's English sessici North America 2200-2245 on comes through well in Colo. (Kir

Sweden — Radio Sweden, Stockholm, is good level in En! 2300A. (Lund, Iowa) weak signar 15.155 noted 1200-1215; some (Kirby, Mo.) Noted with English 0715 on 15.155. (Kubachi, Mass.)

Syria - Radio Damascus, 11.9 noted with French news 1600 tot rope. (Mesquita e Sousa, Portu Noted in English 1700-1730 closed news 1715. (Kroll, N. Y.) Appr parallel with 11.750A to Latin A. ica closing around 2100. (Scher N. J., others)

Tahiti-Radio Tahiti, 6.134, Papa can be heard from around 2330) in to 0100 sign-off, using mr French. Sign-on is listed 2245. (C Nevada) Papeete is heard on 6.9. good level to 0130 closedown; no lish; native to 0015, then Fr (Cushen, N. Z.)

Taiwan (Formosa)—BED4, 1 still noted with English to En 1320-1345; has French around! "The Voice of Righteousness," Lin, Taipeh, says in part, "Our tion broadcasts in both Chineses English on 7.300, formerly 7.401 1700-2000;" asked for reports on lish session. (Pearce, England) B opens 0630 or 0700 daily on 7.355, level. (Williams, Australia) LI Taipeh has been noted on new s ule to Western North America 0100, news 0030; fair on 15.235, on 11.735. (Balbi, Calif.) BI 10.080, heard 0400 with Chinese and Western music; BED32, 9.1 heard 0415 with Western music, Chinese news; BED24, 9.820A, 0430 with Western music and Ch news, bad QRM. (Sanderson, tralia)

Thailand (Siam)—The Thai Signal Corps Radio Service, HSI;

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heard daily 0630-0700 on 4.875; poor signal in Austral The Overseas Service on 11.700 is strong from 0600, though has some QRM from Radio Japan, 11.705. (W liams) Has news 0515-0530; service runs 0500-0700. T lower-powered transmitters now open 0630 and carry T Home Service. Call on 11.700 appears to be HSK9. (Ra-Australia, others) Is heard on 6.000A parallel the 11' outlet. (Williams)

Trieste—The British Forces Station, 15.125, signs 1800 with "God Save the Queen." (Ferguson, N. others) Station officials say "The Service is intended comparatively local reception and you may find to future listening conditions will deteriorate as we may final adjustment to our aerial system." (Patrick, Englar Should sign on at 1100.

Turkey—The Technical School of Istanbul station been off the air this summer, but should return by middle of October—presumably on old channel 6.693 (WRH) The Technical University of Istanbul is heard: 7.030 from about 1315 to 1500 (except Sat.); is to increa power shortly to 1 kw.; has CWQRM. (Patrick, Englg and others)

USI (Indonesia)—Djakarta, 9.710, noted with mu 1000 and announcement in very poor English, (Hard Washington State) Plans to install two more 50 kw. tra mitters; these are expected in Indonesia at the end this year and might be in use soon after that "to enlal and to improve our foreign broadcasts," officials have formed Scheiner, N. J. according to the N. Z. DX Tini YDD, 3.205, Djakarta, is good level in N. Z. 0730 v news in Indonesian, and Jogjakarta, 5.060, is strong le there at 0800.

USSR-Alma Ata, 9.340, has been heard in Swer 0900. (Skoog) Grenell, Ohio, says Radio Moscow is c ing through nicely all day (EST) on 11.78, 9.59. Vatican—HVJ, 11.74, is sometimes readable 1315-1

in English period. (Niblack, Ind.; Scheiner, N. J.)

Venezuela—YVOA, 4.830, signs on 0530; YVNB, 4.820 heard 0630 atop Singapore, Malaya. (N. Z. DX Times:

Yugoslavia—Radio Yugoslavia has English 0115-013(3 9.618, 6.100; at 1645-1700 on 6.100. (Pearce, England) native musical session 2200-2230 daily on 6.100, 9.9 (Bellington, N. Y.)

Press Time Flashes

Arthur T. Cushen, Invercargill, N. Z., for many yo a regular contributor to the ISW DEPARTMENT, recently awarded the Coronation Medal by Her Maja Queen Elizabeth II, for the POW work he has done the years. Arthur has received his 1000th BCB veri tion, and his s.w. veries now total around 1600.

"Deutsche Welle", Cologne, "The Voice of Germa has informed Scheiner, N. J., that reception reports ' be verified with a QSL card if, aside from technical d details about 15 minutes of programming are includel order to allow for a clear comparison with our prop. lists". QRA is Deutsche Welle, Koln, NWDR, Wallraff 5, Cologne, Germany.

Canada's service for the Northwest Territories is li daily 2340-0020 over 9.585, 6.060; Mon.-Fri. only, 0725-5 over 11.90,9.63.

Radio Cotonou, Dahomey, operates in French, Dahomedialects 0145-0200, 1225-1330 (to 1400 Sat.) over 1485 1 kw., and on 41 m. with 250 watts (to be increased) kw. in 1954). (Scheiner, N. J.) What is 41-m. frequence

A Colombian station on 6.196A has been heard are 2228 when identified as "La Voz de Cali." (Belling N. Y.; Niblack, Ind., others) Radio Sweden lists cale HJEZ, but Stark, Texas says is "La Voz del Valle," (moved up from 6.135, with call of HJEV.

Berne, Switzerland, recently tested (with relay of European program) on HER22, 3.961; HER33, 3 HER44, 3.989; heard well in Britain around 1700. (Per Catch, Patrick)

Listeners in the South Pacific have been alerted to port reception as soon as the new station on Pite Island takes to the air; watch for a report on this over Radio Australia's DX session Saturday 2300, 15 repeated Sunday 0830, 9.615.

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English broadcasts from Radio Sweden are 1930-202 2100-2145, 2200-2215, 9.535; 2300-2315, 15.155; 2300-2311.880; 0000-0030, 15.155; 0600-0615, 0700-0715, 0800-0800 0930-1030, 1200-1215, 1300-1315, 15.155; 1500-1530, 6.00 1800-1815, 11.880. (ISWC, London)

Current Paris schedules include French 2230-2245, 7.1 0030-0130, 9.550; 0145-0230, 11.920, 15.240; 0230-0300, 15.2 17.850; 0530-0600, 15.240; 0758-1000, 15.400, 17.850; 111215, 15.350, 17.850; 1215-1300, 9.675, 11.845; 1500-155.995, 7.105, 9.685; 1500-1630, 11.700, 15.240; 1730-1800, 9.6 1830-2000, 9.685, 11.700. English 0145-0200, 7.240; 151600, 6.045. German 1300-1400, 6.045. Spanish 1600-165.955, 7.240; 1800-1815, 9.685, 11.700. Portuguese 0200-0201300-1315, 7.240; 1400-1430, 7.240, 9.765. Home service lays are Program National on Sun. 0400-0500, 7.200; F gram Paris-Inter, weekdays 0100-1100, 6.200, 1100-1856.200, 9.550; Sundays 0130-0400, 0500-1115, 6.200, 1115-1856.200, 9.550. (WRH)

A French-speaking station heard on 6.11A at 0 through heavy QRM may be *Radio France-Asie*, Saigi Indo-China (Vietnam), no longer found on 9.75A at time. (Balbi, Calif.) *Radio Renascenca*, Portugal, operation 6.154 at 1230-1800. (Radio Sweden)

on 6.154 at 1230-1800. (Radio Sweden)

Latest schedule of "Deutsche Welle." Cologne, C
many, is 2030-2330, 5.980, 7.290 (to North America)
0530-0830, 15.275; 0930-1230, and 1700-2000, 11.795.

Acknowledgement

DISTRIBUTOR SEMINARS PLANNED

THE JOINT Electronic Parts Show—NEDA committee tappropriated \$30,000 to conduct a series of regional series and educational programs for distributors, replacing educational sessions formerly held during the Parts Show

Tentative plans include seminars to be held in central located cities in six trade areas.

FOR TELEVISION ANTENNA IN FRINGE AREA

TOWERS OF STRENGTH

TO LAST A LIFETIME

Self-supporting tower built up c galvanized steel sections. No gu, wires necessary. Easy to erect. Safa and resistant to high wind. Available in heights 47 ft., 60 ft., 73 ft. 87 ft. and 100 ft., with bases i proportion.

FRINGE AREA TV BUYERS MUSI HAVE SPECIALLY BUILT TOWER FOR CLEAR RECEPTION

Tower and the TV set go hand i hand as a package sale to rura TV buyers. Provides an extra sale and profit to dealers. An excellent fast selling accessory for jobben and dealers.

TERRITORIES OPEN FOR JOBBER DEALER FRANCHIS

Write for complete structural de tails, packing, prices, discount and territorial assignment.

MANUFACTURED BY

AERMOTOR CO.

Dept. 6110, 2500 Roosevelt Road, Chicago 8, Illinois
BUILDERS OF STEEL TOWERS SINCE 1888

NO NTEREST!! Buy on our radically new

Time Payment Plan

NO CARRYING CHARGES

Superior's new Model 670-A

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms CAPACITY: .001 to 1 Mfd. I to 50 Mfd. (Quality test for elec-

REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries DECIBELS: -6 to +18 +14 to +38 +34 to +58

ADDED FEATURE:

The Model 670-A includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

The Model 670-A comes The Model 6/0-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions.



sures 61/4" x 91/2" x 41/2"

Superior's new Model TV-11

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron, Miniatures, Sub-Miniatures, Novals, Sub-minars,

Miniatures, Sub-Miniatures, Novals, Sub-Miniars, Proximity fuse types, etc.
Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.

The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible

to damage a tube by inserting it in the wrong

to damage a tube by inserting it in the wrong socket.
Free-moving built-in roll chart provides complete data for all tubes.
Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.
NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful handrubbed oak cabinet complete with portable cover

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscil-

lator incorporated in this model will detect leakages even when the frequency is one per minute.

9

Model 660-A comes complete with coaxial cable test lead and instructions.

Superior's New Model 660-A AN AC OPERATED

PROVIDES COMPLETE COVERAGE for AM-FM & TV Alignment

SPECIFICATIONS:

SPECIFICATIONS:

Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 220 Megacycles on powerful harmonics. Accuracy and Stability are assured by the use of permeability trimmed Hi-Q coils. • R.F. available separately or modulated by the internal audio oscillator. — Built in 400 cycle sine wave audio oscillator used to modulate the R.F. signal àlso available separately for audio testing of receivers, amplifiers, hard of hearing aids, etc. • R.F. Oscillator Circuit: A

high transconductance heptode is used as an R.F. oscillator, mixer and amplifier.
Modulation is effected by electron coupling
in the mixer section thus isolating the oscil-In the mixer section thus isolating the oscillator from load changes and affording high stability. • A.F. Oscillator Circuit: A high transconductance heptode connected as a high-mu triode is used as an audio oscillator in a High-C Colpitts Circuit. The output (over 1 Volt) is nearly pure sine wave. • Attenuator: A 5 step ladder type of attenuator is used.

Tubes used: 1-6BE6 as R.F. Oscillator, mixer and amplifier. 1-6BE6 as Audio Oscillator. I-6H6 as Power Rectifier.

IOSS	ELEC	TR	ONIC	D	ISTRI	BUTI	NG	C	0.,	IN	C.	
ept.	B-77,	38	Murro	y	St.,	New	Yor	k	7,	N.	Y.	

Please send me the units checked. I am enclosing the down ayment with order and agree to pay the monthly balance is shown. It is understood there will be no carrying, interest or any other charges provided I send my monthly payments when due. It is further understood that should I fail to make ayment when due, the full unpaid balance shall become unmediately due and payable.

Name.																			

MODEL 670-A.....Total Price \$28.40 \$7.40 down payment. Balance \$3.50 monthly for 6 months.
 MODEL TV-11...Total Price \$47.50 \$11.50 down payment. Balance \$6.00 monthly for 6 months.

MODEL 660-A...... Total Price \$42.95 \$12.95 down payment. Balance \$5.00 monthly for 6 months.

☐ I enclose \$.....as down payment. City...... Zone..... State......

Ship C.O.D. for the down payment.



WHAT'S _ _ ----

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page and the issue number, delay will be avoided.

TAPE RECORDER

Crescent Industries, Inc., 5900 W. Touhy Avenue, C cago 31, Illinois is marketing a low-cost tape record the Model 907.

The new recorder is a dual-track, 7½ inch-per-second machine with fast forward and rewind, essentially if frequency response from 70 to 8500 cps, less than ½ oper-cent wow and flutter, a 3-watt amplifier, and only control for record and play. It will handle up to 7 in reels, gives two hours of recording time, has mike a radio-phono input, plus 3.2 ohm output for speaker thigh impedance output for connection to an external applifier.

A companion model, the 903, is available for those v want the 3.75 inch-per-second speed.

A data sheet on this new recorder is available from a company on request.

BATTERY ELIMINATOR-CHARGER

Electronic Instrument Co., Inc., 84 Withers Stronger Brooklyn 11, New York has responded to the demand a combined 6 volt and 12 volt battery eliminator; charger by bringing out the Eico Model 1050 in kit; wired form.

The unit is designed for use as a battery eliminator the servicing and demonstrating of both 6- and 12-v operated auto radios, marine and aircraft equipment, for charging both 6-volt and the new 12-volt storp batteries.

Rated above normal needs in these applications fully protected against overloads, the Model 1050 in porates continuously variable output voltage, separal voltmeter and ammeter, and quality components throw out. In kit form, the instrument is designated as a Model 1050-K.

METAL DETECTOR

The Radiac Company, Inc., 489 Fifth Avenue, New Y 17, New York is currently offering the "Private Eye, portable ten-pound electronic detector for locating men and minerals in all terrains, flat or mountainous.

A unique, simplified, high-efficiency circuit provides high sensitivity and penetration. The unit was designed for use by public utility companies and engineers as well as for treasure hunters, prospectors, etc.



The "Private Eye" is enclosed in a baked enamel, minum case of modern design. It uses low voltage rebatteries and consists of transmitter and receiver 1 may be folded in suitcase fashion when not in use.

GERMANIUM DIODES

Hermetically-sealed germanium diodes in product quantities are now available from *Hughes Aircraft Copany's* Semiconductor Department, Florence Ave. at Tost., Culver City, California.

The units are supplied in seventeen RETMA (RTF types, including three JAN-approved diodes, as well-other types laboratory-tested to customers' special quirements.

r glass-to-metal seal is made by a special *Hughes*bed process of fusion sealing at high temperatures.
sult is a rigid, one-piece glass envelope which incomplete freedom from moisture penetration of the
convelope.

riries on these diodes should be sent to the firm's unductor Sales Department.

WILCOX-GAY PHONOGRAPH

ox-Gay Corporation, 79 Washington St., Brooklyn 1, has entered the home high-quality phonograph in-



strument field with a new table model automatic player for all type records.

The especially-designed, three-speed changer utilizes a turn-over ceramic cartridge with sapphire needles which is used in conjunction with a custom-built amplifier with push-pull amplification. The set uses two sidemounted 6-inch

ers featuring extra-heavy *Alnico* magnets. The cabityled with a rounded front, has a built-in acoustic per which is constructed to match the electrical rements of the speaker system and amplifier.

four-tube amplifier delivers 3 watts of audio outfrequency response of the unit is 40 to 12,000 cycles.

VOLTAGE REGULATOR

on Instrument Corp., Division of American Car and dry Company, 291-26 State Highway #17, Paramus, Jersey has developed a new a.c. regulator for 400-

rms output voltage is adjustable with regulation to cr-cent up to half the rated load (50 volt-amperes) to .02 per-cent up to the full rated load (100 volt-ces). This regulation is maintained with allowable voltage fluctuations of \pm 10 per-cent, about the ted output level and frequency fluctuation of \pm 5 and the covery time from transients is less than .01 d. Developed harmonics are less than 1 per-cent.

regulator measures $17'' \times 9\frac{1}{2}'' \times 7''$ and is easily ble or suitable for bench mounting. Further inform will be supplied by the manufacturer on request.

PRECISION RESISTORS

e Resistor Corp. of Erie, Pa. is now in production on att deposited carbon precision resistors in values from thms to ½ megohm. Standard tolerances are 1, 2,

distinctive feature of this stable pyrolytic resistor, nated as Style 155, is the one-piece molded case. The posetting molded insulation provides protection at humidity and also gives assurance against melcal damage to the carbon film. Added insulating ing is not required on these units.

VIBRATOR TESTER

R. Mallory & Co. Inc. of 3029 E. Washington St., Inlipolis 6, Ind. has added a vibrator tester to its line rvice equipment.

e 12VT1D is designed as a companion unit to other topower" bench power supplies and will test directly, but adapters, either 6 or 12 volt vibrators of the most lar types and all auto radio vibrators used since 1940. conjunction with a filtered d.c. power supply, such as *Mallory* 12RS6D or 12RS14D, the vibrator test-

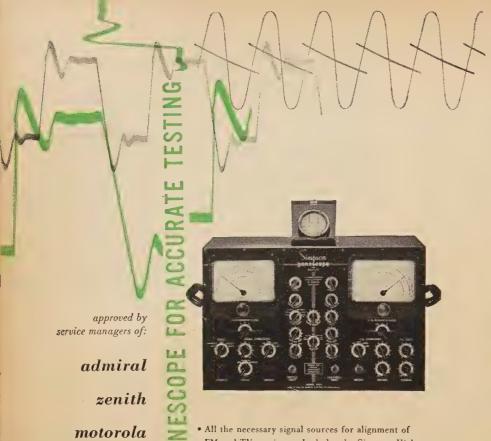
a complete line of dependable performers...



AMPHENOL'S complete line of UHF and VHF television antennas offer viewing satisfaction to every set owner. Because of their superb electric characteristics, qualities engineered by AMPHENOL, each antenna assures the finest picture quality that a set can deliver. Because of their sturdy construction, fine materials assembled in a rugged example of craftmanship, each antenna gives long years of trouble-free performance.

In every television set installation, remember the importance of viewing satisfaction and specifian AMPHENOL antenna.





FM and TV receivers . Includes the Simpson High Sensitivity Oscilloscope and high frequency crystal probe for signal tracing . Independent, continuously variable attenuators and step attenuators for both AM and FM units offer complete control of output at all times • 0-15 megacycle sweep is provided by a noiseless specially designed sweep motor based on D'Arsonval meter movement principles • The exclusive Simpson output cable (illustrated) includes a variable termination network, quickly adapted to provide open, 75 or 300 ohm terminations -the addition of a pad provides attenuation and isolation. Use of appropriate resistors across certain terminals will provide any other termination required, A .002 MFD blocking condensor can be added on any termination for use on circuits containing a DC component • The FM generator output voltage is constant within .2 DB per MC of sweep.

dealer's net \$475.00

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie St., Chicago 44, Illinois • Phone EStebrook 9-1121 • In Canada: Bach-Simpson, Ltd., London, Ont.

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You can enter this uncrowded, interesting field, Defense expansion, new developments demand trained specialists. Study all phases radio & electronics theory and practice: TV; FM; broad-casting; servicing; aviation, marine, police radio. 18-month course. Graduates in demand by major companies. H.S. or equivalent required. Begin Jan., March, June, Sept. Campus life. Write for catalog.

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SPEAKER RECONING

Complete line Cones, Spiders, Rings and Voice Coils. Custom Built Voice Coils. Low prices. Write for Parts List and Reconing information.

WESTERN ELECTRONICS CO.
3164 West Colfax Denver 4, Colo.



er will test accurately either selftifying or tube-rectified vibrators any frequency from 100 to 250 cyc

Over-all dimensions are 6¾" h 10%" wide, and 5½" deep. Shippy weight is approximately eight pour

TRANSISTOR TESTER

Dunn Engineering Associates, s Windsor Street, Cambridge, Mass, s introduced a new piece of test eqs ment, the DEA Model 2 transir characteristic plotter.

The new unit automatically dispensive one of four different families static characteristic curves on a face of an auxiliary oscilloscope, sets of curves presented are the trifer characteristic and the collectoracteristic for both grounded-eter and grounded-base connects. The rapid repetition rate of the plays obviates flicker and thermal



fects. Both *n-p-n* and *p-n-p* junctransistors as well as point-conunits can be accommodated.

The unit is intended for both duction line and laboratory uses descriptive bulletin is available the manufacturer.

POWER SUPPLY

Lee Electronic Labs, Inc., 233 ley St., Boston 19, Mass. has develor a new miniature electronic powerply, Model PS-1, for use with Model E-C or E-A circuit analyzed

The new unit provides both a.c. d.c. test voltages, permitting and tremely wide range of resistance continuity tests and increasing sensitivity of the analyzers to 200 megohms.

The Model PS-1 features a m



ture selenium rectifier and duals denser RC filter network in a secircuit. The plug-in design, to n the analyzer models, comes wis 6 foot power cord and rubber plus operates on any 100-125 volt a.c.

18-INCH WOOFER

C.-S. Manufacturing Company, Lincoln Blvd., Venice, Californ

MONEY BACK GUARANTEED O RECEIVE All UHF and 4ee vhf stations in Aee IRECTIONS FOR 60 MILES ITHOUT A ROTORMOTOR

DRLD'S MOST POWERFUL UHF-VHF **TELEVISION ANTENNA**

While antenna reception is guaranteed for 60 miles, perfect pictures have been consistently received as far as 160 miles from stations.

NEW DESIGN FOR '54

- LOW-LOSS SWITCH
- LOW-LOSS PHENOLIC INSULATORS
- USES NEW 4-CONDUCTOR MATCHED IMPEDANCE LINE
- ONLY 10 INCH SPACING BETWEEN ANTENNA BAYS

ONE INSTALLATION

ONE ANTENNA

Money Back Guarantee IN EVERY AREA WITH STATIONS IN ALL DIRECTIONS The new All Channel Model Super 60 is guaran-IN ALL LOCATIONS teed to bring in, immediately on installation, every Teed to pring in, immediately on magnification within 60 miles in any UHF and every VHF station within 60 miles in any direction, giving clearer and sharper pictures than any antenna or combination of antennas with or If, immediately on installation, it fails to do this, we agree to refund to the jobber to whom we without rotor motors. sold and shipped it, his full purchase price.

BE READY NOW --- FOR THE FUTURE

SO NEW! SO DIFFERENT! IT'S PATENTED! # 2,644,091



selector switch electronically

LIST PRICE SEE YOUR LOCAL JOBBER.

MODEL

PRICE INCLUDES

Complete stacked array • 4 stacking bars • 9 position switch • Switch-to-set coupler • 3 - 71/2" stand offs . Individually boxed in mailable carton

ALL CHANNEL ANTENNA CORP., 70-07 QUEENS BLVD.



now marketing an improved 18-inch woofer, the Model #CS-518.

Frequency response is from 30 to 4000 cps; maximum power input is 25 watts; impedance is 12 ohms. The cone resonance is 27 to 31 cps. The over-all diameter of the speaker is 18 inches, the baffle opening is 161/4 inches, and the depth behind the panel is $7\frac{1}{2}$ inches.

Information for bass-reflex, hornloading, and air-coupler enclosures may be obtained from the manufacturer on request.

TRADEMARK DECALS

Tekni-Labels Company, 232 North Glenoaks Blvd., Burbank, California has added an "Alphabets" and "Trademarks" series to its line of decals.

The new series are available in four colors: white, black, red, and gold. With these new sets it is possible for individual technicians to make their own trademarks, name plates, decorative panel designs, etc. By combining portions of different colored decal sets, multi-color designs and trademarks can be made.

R.F. BRIDGE

Boonton Radio Corporation, Boonton, N. J. has recently introduced a new completely self-contained r.f. bridge, the Type 250-A RX meter.

The new instrument permits the direct measurement of equivalent paral-



lel resistance and capacitance of twoterminal networks over an unusually wide frequency range. It has a frequency coverage of 500 kc. to 250 mc. in eight ranges; a resistance range of 15 to 100,000 ohms; and a capacitance range of $+20 \mu\mu fd$. to $-100 \mu\mu fd$. Resistances from 0 to 15 ohms may be determined by indirect means while the capacitance range can be increased to 0 to 120 $\mu\mu$ fd. by use of auxiliary resonating coils.

The company will provide complete details on request.

"MICRO-POLISHING" PROCESS

Reeves Soundcraft Corporation, 10 E. 52nd Street, New York 22, N. Y. has developed and patented the new "Micro-Polishing" process which is now being used in the manufacture of the company's complete line of magnetic recording tapes.

The new process develops high mechanical stresses on the oxide nodules and the surface of the tape, resulting in a mirror-smooth finish, thus practically eliminating drop-outs and increasing the accuracy of magnetic calculating systems.

All of the company's magnetic re-

SPECIAL OF THE MONT

GENERAL ELECTRIC R.F. AMMETER 0-4 Amp R.F., 2 Inch Round, BRAND NEW STANDARD BRAND OIL CONDENSER Wid. 1500 V. DC.

NON-INDUCTIVE RESISTORS Ohmite, 250 Ohm, 100 Watt.

Special, 5 for \$2

SOLA CONSTANT VOLT. TRANSFORME

PLATE TRANSFORMER 1000-O-1000 Volts @ 400 mills. 115 v., 605 pri. Removed from equipment but guarant perfect....ea. \$1

BLOWER MOTOR

Squirrel cage, 140 CFM. 115 volt 60 cy. motor. Extremely quiet. Made by Redmond. SRAND NEW

A.C. RELAY

220 V. 60 cy. Model 506. Cutler-Hammer SPST 15 amp. or 1/2 H.P. contacts. NEW

MOBILE DYNAMOTORS; MADE BY PIONEER AND EICOR &

6 Volts Input, 425 Volts at 375 MA Output, 63/4" Long, 4" Di-ameter. Weight 10 lbs. List Price Approx. \$70.00. BRAND NEW, ONLY.

CARTER SUPER DYNAMOTO

12 Volts Input, 400 V. Output @ 200 MA tinuous or 375 MA Intermittent duty. Model B Designed for Police, Aircraft and Marine Use. Small, rugged and effi-BRAND NEW, ONLY....

CONTINENTAL MOBILE DYNAMOTORS 11.5 Volts Input, output 270 V. @ \$8.953 11 Volts input, output 475 V. @ \$19.951

12 VOLT D.C. ANTENNA RELAY
Micalex insulation DPDT......

G. E. RELAY CONTROL

(Ideal for Model Controls, Etc.)

Contains a sigma midget 8,000 ohm, relay (at less than 2 MA), high impedance chokek metal strip, neon pilot and many useful p The sensitive relay alone is worth much than the total low price of . . . \$1.25 Each 10 for \$9\$

Panel Meters NEW GOV'T SURPLUS STANDARD BRANDS

0-150 ma De. 3.49 8 MFD-1330 VB C 1.50 VB C 1.

BARGAINS S

OIL CONDENSE

WIRE WOUND RESISTOR

Stock too long to list. We can supply mos so order what you need.

10 Watts. From 20 Watts. From 4 0hms to 50K 0hms. 25 Watts. From 5 0hms to 100K 0hms. 100 Watts. From 5 0hms to 100K 0hms. 100 Watts. From 5 0hms to 100K 0hms.

VACUUM CONDENSERS

50 mmf. 5 KV. General Electric..... 100 mmf. 20 KV, Jennings

I 1 MEGOHM, 1% W.W. PRECISION RESIST

BAKELITE CASED MICAS

Phone WOrth 2-5439

City.....Zone

mig tapes are now being subjected process at no increase in the is g price.

ATR INVERTERS

rican Television & Radio Com-300 East Fourth St., St. Paul, usota has introduced a series of notodels in its line of inverters. new units operate from 6- or



ct car storage batteries and pro-110 volt a.c. 60-cycle output in hs wattage capacities for the opin of dictating machines, tape rers, wire recorders, radio sets, test ment, and other related small vical or electronic apparatus.

erter models are also available perating from other d.c. input ges ranging from 6 volts d.c. to dolts d.c.

Inplete literature is available the factory.

RADIOPHONE

rnmunication Research & Develnt Co., Inc., 9530 Aurora Ave., le 3, Washington is now in proon on a new, self-contained radiowhich weighs only 14 pounds. fown as the Model B-3, the set es portable radio batteries and be supplied for any frequency 2 to 30 mc. with crystal control th sending and receiving. The reor uses two 1L4's, a 1R5, a 1U5,



output push-pull 3S4's. The transer section uses six 3S4's. e company will supply full details ne Model B-3 on request.

METER CALIBRATOR
Albfell Laboratories, Inc., P. O.
1578, San Diego 10, California has d a meter calibrator to its "Kayline of electronic instruments. e Model 123 is a precision d.c. refce source which produces a cali-



Here's proof of how Perma-Tube resists corrosion



Section of ordinary conduit tubing used for TV masts after 96 hours in a salt spray test (A.S.T.M. Designation B-117-49T) to accelerate corrosion. Extensive rust inside the mast has reduced strength —caused rusty water to drain onto the owner's home.



Section of PERMA-TUBE after 500 hours salt spray test shows no evidence of corrosion. Strength has been retained and the chance of rust streaks on owner's home is eliminated. Note sturdier wall thickness of PERMA-TUBE sample.



PERMA-TUBE IS AVAILABLE IN STANDARD LENGTHS . . . DIAMETERS . . . WALL THICKNESSES. FOR COMPLETE INFORMATION MAIL THIS COUPON.



Jones & Laughlin Steel Corporation 495 Gateway Center, Pittsburgh 30, Pa.

Without charge Name of nearest distributor please send me Complete information on PERMA-TUBE

Company_



CUSTOM-BUILT TV CABINETS

LEADING STYLES in genuine Mahogany or Walnut (blond 10% extra. Drilled for a #630 or blank knob panel for any make TV SET. Complete as pictured for 16", 17", 20" or 21" C.R.T.

The VOGUE



H-41", W-25", D-23" H-25", W-26", D-22"

\$5937 Incl. Mask, Safety Glass, \$3989 Brackets, Decals, Etc.

PARTS FOR #630 TV SETS

I MILLO I ON # OOO I I O	
TV WIRE & SOLDER KIT, for any Set	1.49
630-KIT, screws, nuts, rivets, washers, etc 3	
PUNCHED CHASSIS PAN, cadmium plated	4.87
UNIVERSAL CRT MOUNTING BRACKETS.	6.97
STANDARD CASCODE TUNER, incl. tubes.	22.49
ESCUTCHEON PLATE, for tuner	.69
COMPLETE SET OF KNOBS, incl. decals	1.34
POWER TRANSFORMER, 295ma, 20176	9.97
VERTICAL OUTPUT TRANS. 204T2	2.69
VERTICAL BLOCKING TRANS. 20872	1.32
HORIZONTAL OUTPUT TRANS. 21175	3.98
FOCUS COIL. 470 ohms. 202D2	3.42
PEFLECTION YOKE, Cosine 70°	3.98
AGC KIT, complete with instructions	4.59
VIDEO AND I.F. KIT, 19 items	7.84
VARIABLE CONTROL KIT, 9 controls	5.83
CARBON RESISTOR KIT, 107 resistors	6.98
WIREWOUND RESISTOR KIT, 4 resistors	2.31
BRACKET AND SHIELD KIT, 18 items	8.63
ELECTROLYTIC CONDENSER KIT, 6 cond.	7.37
TUBULAR CONDENSER KIT, 38 condensers	4.28
CERAMIC CONDENSER KIT, 28 condensers	3.37
MICA CONDENSER KIT, II condensers	1.38
BROOKS BARIO S TV SORB	04.14



Build your own SUPER DELUXE 31-TUBE

#630 TV CHASSIS With U. H. F.

#630 SUPER DELUXE 31-TUBE With a #630 SUPER DELUXE 31-TUBE
TV KIT including your favorie U.H.F. Station.
Engineered in artist adherence to the genuine RCA
260 PERATES 167 to
260 PERATES 167 t

NOTHING BETTER AT ANY PRICE! \$1 Only .

#630 SUPER DELUXE TV CHASSIS \$15797

Complete Ready to Play (less CRT)

#630 SPECIALS BY TECH-MASTER

STANDARD PICTURE TUBES—1 Year Guarantee

17"-\$29.63 21"-\$44.68 24"-\$58.26

Brooks LIFE-SIZE TV Instructions, for building any #630 TV Receiver..Postpaid

HINTS FOR BETTER PERFORMANCE on \$1.00 your #630 TV Receiver......Postpaid

Brooks CASCODE MANUAL, how to install Cascode Tuner in any make TV Set. Postpaid

BROOKS RADIO & TV CORP., 84 Vesey St., Dept. B, New York 7, N. Y.

ANOTHER OUTSTANDING JOBBER
CENTRAL RADIO SUPPLY 609 West 1st Street Hastings, Nebraska HAS THE

SENSATIONAL NEW EIGO 1050-K 6V & 12V BATTERY ELIM. KIT IN STOCK!



Att.: Schools, Labs, Hams! Cash in on your surplus Radio Parts & Equipment! We pay more—or trade for something you really need. TV Sets, Mobile Equipment Available for Trade. Write Now!

HARJO SALES CO. 4109 Burbank Blvd. Burbank, Calif. Cable HARJO

STANDARD TUBES

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brated voltage essentially independ of input line voltage and output h variations.

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The relay action is initiated by ternal contact as high as one megohm with current as lowy 1/10,000 ampere. The unit mount a standard 4-inch electrical conner box and will operate on 115 voltst 60 cycles, single phase. Other voltl and frequencies are available on h cial order.

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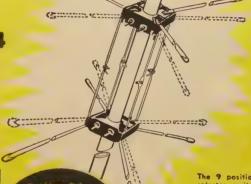
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1954 G-E TV Sets

(Continued from page 66)

noise pulse is bypassed to ground. Each noise pulse, therefore, short-circuits the sync amplifier output and the noise pulses are thus prevented from reaching the clipper grid.

Oscillographic examination of the sync amplifier output on noise-ridden signals will show actual "holes" in the composite sync and video signal. These "holes," which extend to the baseline, are the inverted noise pulses that have committed suicide.

The inherent flywheel effect of the horizontal and vertical oscillator circuits tends to maintain synchronism during periods when sync pulse output is lost at the clipper because of noise inverter action.

 $R_{\rm 304}$ and $C_{\rm 322}$ in the grid circuit of the inverter form a filter that prevents signal voltages from appearing on this grid. This filter does not, however, impede the relatively slow changes in bias obtained from the second detector.

Switch S_{301} is a "local-fringe" switch located on the rear apron of the chas-

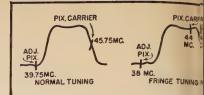


Fig. 7. Response curves for both none and fringe areas to provide best tunial

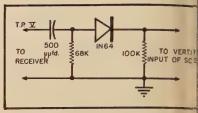


Fig. 8. Detector circuit for step 4, Take

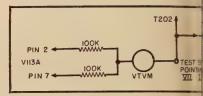
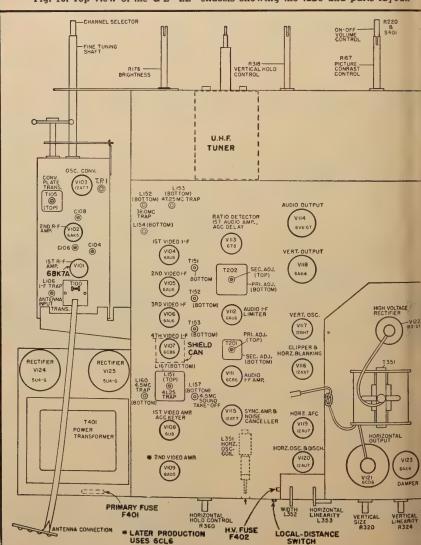


Fig. 9. Resistor network used in steps Table 1. The resistors are equal within a

Fig. 10. Top view of the G-E "EE" chassis showing the tube and parts layout.



the "local" position, the output ync amplifier is reduced by dethe plate load; simultaneouscathode bias on the noise inis increased so that this tube t conduct on the tips of sync on strong signals.

inverter test: To test the verter, connect an oscilloscope output of the sync amplifier ain a relative, composite sync evel. On sets so equipped, set ocal-fringe" switch to the ' position. Next, open the cathcuit of the noise inverter or 2_{340} with a 22,000 ohm resistor. of these operations should rea slight increase in sync pulse in the oscilloscope. In normal on in strong signal areas, the nverter tends to "wipe-off" a mount of sync pulse. Thus, disthe inverter should increase vel slightly. In noisy, fringe the noise-inverting action of cuit can be clearly observed by the "holes" in the video and gnal at the sync amplifier out-

T. circuit: The pentode section 6U8 (V_{108B}) is employed as a tube whose plate supply conpositive pulses taken from a the high-voltage transformer. reyed a.g.c. has been covered in brevious articles, a detailed exon of this circuit should not be

arv.

jointed out earlier, it is highly ble to operate the 6AK5 second ge without a.g.c. in fringe areas tain the best signal-to-noise This is accomplished by bucking w a.g.c. voltage levels through age divider network connected 3+" source. Diode V_{1130} ($\frac{1}{4}$ of a cts as a clamp to prevent posicoltage from appearing on the grid. With strong signal recephe a.g.c. voltage rises above the vg voltage and the diode can be ered out of the circuit.

ical and horizontal blanking: al retrace blanking is accomd by feeding a highly positive ' to the cathode of the picture luring the retrace period. This is picked off the plate of the all output tube, sharpened up entiated) by R_{328} and C_{317} and fi to the picture tube cathode th R_{330} and C_{174} . V_{116B} , the horiblanking triode, performs no on in the vertical blanking op-

izontal blanking is accomplished ain feeding a positive pulse to thode of the picture tube during corizontal retrace period, thus g the tube to cut-off. V_{116B} , the ntal blanking tube, is connected athode follower. Positive pulses, l off the high-voltage transformough $C_{
m 368}$ are applied to the grid blanking triode. These pulses r in the same polarity but at a impedance at the cathode of the er and are then fed to the pictube cathode.



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Fig. 11. The G-E "U.H.F. 70" conv. shown with the shield can removed. that the crystal is held by spring

It will be noted that the bright control is ganged to a potention in the screen circuit of the 6CD6 zontal output stage. Increasin brightness setting therefore auto cally increases 6CD6 screen vo This arrangement tends to count picture "blooming" caused by in ing current drain from the high age supply.

The primary line fuse, F_{401} , is s ed behind a protective cover a rear apron of the power-supply sis. A low-voltage tap on the former primary is brought out second set of fuse contacts, hence output from the power supply c maintained in low voltage (1054 areas by switching the fuse to th ond set of contacts on the fuse :

U.H.F. Converter

The "U.H.F.-70" converter c identified in Fig. 1 as the round fee-can" occupying the frontposition on the chassis.

The circuitry consists of a crystal mixer, 6AF4 local oscia and a 6BK7A cascode amplifi shown in Fig. 5. Output of the verter is factory-set to Channel l this can be shifted easily to Chain the field should interference lems arise. Tuning elements i mixer and oscillator circuits are ter-wave transmission lines in form (as seen on the turret i 11). Tuning is accomplished by plated slugs threaded into the lines to act as shorting bars. -

Three sets of tuning element used in a turret-switching arm ment. In the continuous tuning tion, the slugs are driven through gear and vernier arrangements the dual front-panel u.h.f. contra second knob on this control ac the turret assembly permitting tion of the continuous tuning ras

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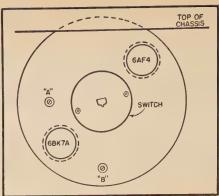


Fig. 12. Rear view of "U.H.F. 70" tuner showing location of i.f. adjustments.

the two "click" positions. A fourth position on this switch disables the u.h.f. converter and permits v.h.f. reception.

Reference to the main chassis photograph (Fig. 1) will show two openings in the front of the u.h.f. tuner which permit access to the mixer and oscillator tuning adjustments. Removal of the u.h.f. knobs on the receiver permits these adjustments to be reached without chassis removal and enables the service technician to tune the two "click" positions to local u.h.f. stations in the area. Viewed from the front, the left opening is for the mixer circuit and the right opening is for the local oscillator.

Tune-up on the click positions consists merely of first tuning the oscillator slug until the station is received and then peaking the mixer slug for maximum signal. The v.h.f. selector should be set on Channel 5 and the v.h.f. fine tuning control set to the center of its range. Two responses will be noted as the oscillator slug is turned clockwise (increasing frequency). The first response obtained as the slug is turned clockwise is the correct one. A second response will show up as the slug is turned further, this being the image response in which the oscillator is tuned above the incoming signal. It may be necessary to rotate the continuous tuning knob slightly to reach the slugs because the cam-gear arrangement covers up one of the adjustments in t course of its travel.

No adjustment is required if ord the continuous tuning range is elployed because mixer and oscillate slug tuning is ganged and tracked of the factory.

When adjusting the r.f. and oso lator tuning slugs be careful not a exert any pressure in the extremelockwise direction as the coil can a come distorted, making it difficult turn the slug. Also, be careful not scrape the coil loops when inserting the screwdriver. A fiber rod type a screwdriver should be used.

If i.f. output on Channel 6 is quired because of a local station of Channel 5, refer to Fig. 12, showing the rear view of the u.h.f. tuner, at the i.f. adjusting screws. These adjustments are underneath the chassis at can be reached on most moothrough the trap door opening at abottom of the cabinet. Turn core (i.f. output transformer) three turn counterclockwise. Turn core "B" (input coil) two and one-half turn counterclockwise. Since the i.f. sponse of the 6BK7A is fairly brothese adjustments are not overly creal.

Table 1 contains the procedure to a followed when aligning the video i sound i.f., and trap circuits of the seciver. Before performing the alignment, however, do the following:

1. Remove the plate cap from V the 6CD6 horizontal output tube. To porarily connect a 2500 ohm, 25 we resistor from the 260 volt "B+" powto chassis.

2. Remove V₁₁₅, the 12AT7 sync a plifier and noise inverter, from socket.

3. Turn the volume control to mir mum and the picture contrast control to maximum. Turn the brightness control fully counterclockwise.

4. Set the channel selector to Channel 11 position. Set the fine thing control to its maximum count clockwise position.

5. Allow the receiver and t equipment to warm up for twee minutes. Proceed to step 1 on Table —30-

Allied Radio Corporation's new two-million dollar home at 100 N. Western Avenue in a Chicago. Reputed to be the world's largest plant for the distribution of electronic equipment, the two-story structure provides a total area of 147,000 square feet. Ultra-modern, air-conditioned salesrooms and warehousing, shipping and receiving sections occupy the first floor area. Offices, reception rooms, and the company's cafeteria are located on the second floor. The expansion was dictated by the fact that the company's 1954 catalogue lists 20,000 separate items as against 8000 items carried shortly after the war. A system of pneumatic tubes and conveyor belts is used in the new building to speed order handling and movement of merchandise. The new location, ten minutes from Chicago's Loop, also offers ample parking facilities.









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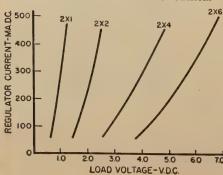
Take advantage of the non-linear characteristics of selenium rectifiers to provide useful regulation.

DEVICE used in voltage regulating circuits to provide a relatively constant output voltage regardless of changes in load current or input voltage is called a voltage regulator. The non-linear characteristic of selenium regulators (rectifiers) makes it particularly useful for regulation purposes.

Heretofore. selenium regulators used in electronic equipment were made of rectifier plates which were not specifically designed for this purpose. This caused considerable difficulty for equipment design engineers, since regulator circuits are usually critical with regard to stability of operation. Selenium plates produced for regulators are manufactured by slightly different techniques than those used for commercial rectifier stacks. The manufacture of the former plates is an intricate process requiring high technical skill, engineering know-how, and the maintenance of rigidly controlled specifications for step in the manufacturing process.

The curves shown in Figs. 2 and 3 are taken from tests made at the Signal Corp Engineering Laboratories on units of one manufacturer of these selenium regulators. The 2X2 type consists of two selenium plates, 14" x 1¼", connected in series on a mounting bracket. This unit is recommended for the regulation of d.c. voltages on the order of 2 volts and constitutes the basic design of a series of regulators for other voltages. For example, units consisting of three or four plates in series are designated as 2X3 and 2X4 respectively. As more plates are added to the basic design, the regulating voltage can be extended to any practical range in the low voltage field. For good regulation, this series of regulators is de-

Fig. 2. Regulation characteristics for various regulators. See text for discussion.



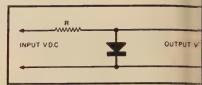


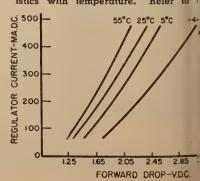
Fig. 1. A basic d.c. regulator circi

signed to operate in the range of to 450 ma. In applications utilizize regulated voltage, with load curin excess of the maximum ratini one regulator, two or more regulamay be placed in series and para respectively or else one regulator another type, e.g., type 2X4, 2X6,6 may be used.

For regulating d.c. voltages, regulator is connected in shunt : Fig. 1). Regulation is accompliby utilizing the forward characters shown in Fig. 2. For example, v the voltage is as required, a no current flows through the regula If, in the operation of the equipm the load current decreases, the age across the load rises. With increased voltage across the regula the regulator current will be high However, this higher current c causes a larger voltage drop as R (Fig. 1) and the load voltage c to its normal value. On the c hand, if the load current increthe load voltage will drop. At lower voltage, the regulator will e less current causing a lower across R and thereby increasing load voltage to its original v Similarly, the regulator will keep load voltage relatively constant gardless of changes in the i voltage.

It will be noted that in Fig. 3 volt-ampere characteristic shifts the right as the temperature is creased. This shift, which is

Fig. 3. Variation of regulation characteristics with temperature. Refer to



of for selenium rectifiers, must be into account when designing elenium regulator into equip-It is sometimes necessary to ze the cells over the entire grature range to be encountered t operation of the equipment. If not done, the regulator, after subjected to a cycle or more of ne temperature, will shift the rcteristic and consequently the ation voltage of the circuit.

ise selenium regulators are proto operate within a small tolerband by carefully controlled ection techniques and are readily able from normal production. narrower tolerances are redue to rigid circuit requirethe desired units are obtainby more careful selection with, urse, a corresponding increase in to the user.

conclusion, it is recommended problems on individual applicamay best be solved by working closely with the manufacturer of selenium regulators.

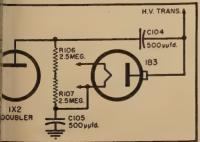
TV SERVICE HINT

By JACK DARR

52 17-inch Philco TV table model eiver with the D-1 deflection chasd a very weak and fuzzy picture, the screen dark most of the time. fugh adjustment of the brightness contrast controls would bring the e back momentarily, it would be out of focus and soon disappear. Alghtness and contrast controls were ed and found OK, as were all the associated with the power supply, amplifier, and video output. eflection chassis, there was a dis-"whispering" sound such as that sated with a large corona discharge. lugh the high-voltage cage was led very well, no glow was visible; ver, the odor of ozone was quite

Finally, the set was turned oneft on for two or three minutes. , thin line of fire was seen crawling id the bottom of one of the 2.5ohm special filter resistors (R₁₀₆) in high-voltage circuit. Tested, this or was found to be open, and the one (\mathbf{R}_{107}) had increased to nearly gohms. The resistor had failed inlly, and this refused to show up the fire broke through the paint. placement of this bad resistor cured negohms for the 17-inch tubes, and rouble. These are special resistors, located just inside the doghouse, the 1B3GT socket to a terminal located near the top cap of the doubler.

tion of the Philco D-1 chassis circuit wing source of possible service fault.



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.44	7X	7					.6	21	25L	6						.4	0
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E 4	12	AU	*			٠.			35V							.3	
.54	12	AV	6				. 5	2	508	5	٠.					.4	
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1T462	6BD5GT98	6SD755	7C650	12BE652	25Z6GT46
1T5GT78	6BD654	6SF5GT 66	7C758	12BH769	35A555
10461	6BE651	6SH7GT52	7E585	12SA7GT57	35B553
10551	6BF566	6SK7GT45	7E665	125K7GT55	35C553
1X2A74	6BF643	6SL7GT 68	7E785	12SL7GT67	35L6GT52
2X21.43	6BG6G . 1.47	65N7GT59	7F769	12SN7GT59	35Z5GT 33
3Q4 66	6BH6 63	6SQ7GT46	7F897	12507GT46	50A555
3Q5GT72	6BJ653	6T885	7G785	14A758	50B552
35461	6BK576	6U8 86	7H761	14AF768	50C552
3V462	6BK797	6V31.09	7J785	148650	50L6GT52
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The "Con-VI"

(Continued from page 85)

to operate on 16 cycles, 160 cyclese 16,000 cycles. These frequency n tiples were chosen to provide widest range with a minimum of o lapping within the range of the strument. The output of the of lator is fed into a 6AQ5 power plifier which produces a maximum approximately 18 volts output. calibrating control R12 is used to: just the output in the calibrating sition S2 to 10 volts on the v.t.v.n.

The a.c. output of the 6AQ5 appo across R_{15} . Resistor R_{15} serves to 1 the electrolytic coupling conded charged up and prevents terminals and L, and those of the v.t.v.m. f "hot." The output voltage being then fed in series with either a i ohm resistor to measure capacitat or a one-megohm resistor to mean inductance. The v.t.v.m. is 1 switched by S2 to either read the put across R₁₅ in the "CAL" position the voltage across the 100-ohm sistor in the C position; or the volu from the L terminal to ground in L position.

A standard full-wave power su furnishes 250 volts at the output the filter and adequately takes of the d.c. requirements of the

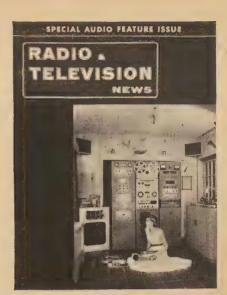
The unit can be quite comfort: fitted in a 6"x6"x6" utility cabine shown in the photographs of the The chassis is a 5"x5½" alumin shelf fastened to the front panel. the constructor desires to use another layout, the usual precautions are cable to amplifier-oscillator consts tion apply, i.e., keep a reasonable tance between grid leads of the 12: and any a.c. carrying leads and c ponents. More specifically, keep power transformer away from 12AT7 and switch S_1 entirely.

Another wiring precaution one which is peculiar to this inst ment only—is to keep the inter stray wiring capacity associated ' the C terminal and the 100-ohm sistor, R_{16} , to an absolute minima Any stray capacitance at this p will show up on the v.t.v.m. as a pacitance, thus upsetting the accur on the lower portion of the low μμfd.) capacitance range.

With the meter in the .01 posis shielding of the meter leads become mandatory to reduce stray pick Millen plug #37212 and terminals ilar to those used on the v.t.v.m. vide a uniform, convenient, and method of hooking up the instrum to the v.t.v.m., particularly since a.c. v.t.v.m. will probably be used: other applications as well. The same terminals were used to proa quick changeover from capacita to inductance measurement. In case, an extra Millen #37222 post spaced an equal 34 inch from both C and L terminals on the panel. to change from capacitance to in

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tance measurement, it is only necessary to remove the plug from the C terminal and ground and re-insert it in the L terminal and ground.

A replica of the scale used on this instrument is shown in Fig. 6. This chart-like scale eliminates the inevitable confusion which would result in trying to figure out which oscillator frequency setting goes with which meter setting, for what capacitance if you see what I mean! In this case, the capacitance full scale markings are in red, the inductance in blue, and the other markings in black. This makes the scale easily readable. A piece of thin lucite is fastened over the scale with self-tapping screws.

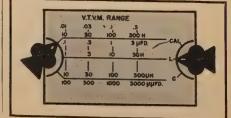
There is only one adjustment necessary on the "Con-VI" after construction has been completed. Adjust potentiometer R_7 until the waveform of the output with the unit in the "CAL" position is a pure sine wave. This can be observed on an oscilloscope hooked up to the v.t.v.m. terminals.

To operate the "Con-VI," hook the unknown L or C to the proper terminals, i.e., between the L or C terminal and ground. Set switch S2 to the "CAL" position. Adjust the calibrate control to produce a reading of 10 volts on the v.t.v.m. Set selector switch S_1 to the appropriate range. This also indicates the correct v.t.v.m. range. Set switch S_2 to either L or C, as the case may be. Read the v.t.v.m. meter scale, and that's it. Actually the procedure is a lot simpler to do than describe.

To compensate for small errors and variations in the oscillator frequency and the v.t.v.m., the output voltage in the "calibrate" position can be varied from the 10 volt setting previously described. Just how much the 10 volt setting should be varied can be determined by substituting a known condenser and adjusting the calibrate control to produce the exact value reading on the v.t.v.m. Switching back to the "CAL" position will show how much compensation is necessary. However errors of this sort should be very small.

The unit "in action" is shown in Fig. 1. The a.c. v.t.v.m. shown is the Heathkit AV-2. Other units, such as those made by Ballantine and Hewlett-Packard, will serve equally as well. The Hewlett-Packard model 400-C, which has full scale readings of .001 volt, can be used to extend the range of the "Con-VI" down to 1 millihenry and 10 micromicrofarads full scale.

Fig. 6. Detail of the scale used on "Con-VI."





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Spot Radio News

Continued from page 18)

ts insofar as systems are conwhich would suggest any rear changing these standards at me in the forseeable future."

balky problem was cited in this gring bid for color; the color Thus far, this manufacturer ed, the tubes demonstrated and hich . . . "production plans have asserted, give only a small picture and costly bluce." The big job ahead, they revolves about the development . . "simplified, large-screen color

that can be manufactured at hable cost." Such a project, they will involve a . . . "great deal irrention and engineering work." ver, they added, it is felt that it do be possible to meet this goal

n two or three years.

compatible color set and partily its variable design features, tole because of the flexibility of the oroposed standards, were aptly bed in the petition, too. Noting there is . . "considerable leem the design of receivers in use the NTSC standards . ." it was ed that it is likely that . . . sufacturers . . . will have difficult ideas as to the optimum deport color receivers."

De Commission has received one is set for test and is expected to smany more during the next few is for study. All will be probed case of operation, lack of critical of controls and registration, and prospective cost to consumers.

ce of the extremely bright items ne color front was announced a days before NTSC filed. The telee company labs declared that they developed a wide-band coax carsystem; a 4.2 megacycle affair, td the L-3 design.' The labs say the system has been so designed high quality results will obtain 4000 miles of transmission. Feai in the new link are line repeatspaced at approximately fourintervals, and connecting termior dropping repeaters. In addition, the route, are equalization oment, power generating, and er transmission plus maintenance pment, at 100 to 200-mile inter-

nis new broadband transmission em will not only insure a striking ity to networked color signals, to black and white transmission, it represents nearly a 100% imement over the present cables.

hile color broadcasting does not lve too many changes in the actransmitter, an array of completary equipment is required for up and feed. According to one dier, several assortments will be lable, depending on the specific reasting schedules involved. For



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broadcasting of network programs only, necessary equipment will include two color-stabilizing amplifiers, and a tri-color monitor with picture tube. For locally-originated color programs, gear needed can include a color slide camera chain, a color film chain, color studio-camera chain, which can consist of a color camera without or with three matched image orthicons. In addition, stations will need test equipment featuring a color bar generator.

Many TV casters are so convinced that the big push in color will begin next summer that they have already entered their orders for local and network equipment. Set makers are equally optimistic, declaring that at least 50,000 tri-color receivers will be made in '54.

SUBSCRIPTION TV and theater TV, a couple of acute headaches plaguing the Commission, have dropped into the halls of Congress and attracted the attention of a Representative from California, Carl Hinshaw. Feeling that both of these forms of transmission are beyond the spheres of actual broadcasting, he has introduced a bill asking that they be placed in the public-utilities category, so that the FCC can set tariffs and rates for types of service rendered, with return entitled on investment as a consideration for such schedules.

The measure, under study by the House Interstate and Foreign Commerce Committee, could prevent the Commission from approving subscription TV as a division of broadcasting.

Presentation of the bill will also probably postpone any immediate consideration of "pay-as-you-see" TV by the Commission, since now FCC members will probably be called one testify before the House committee and they will not meet again unext year when the second session the 83rd Congress convenes.

The Congressman declared that offered his bill to permit a clariful tion of the law involving charges radio or TV programs. He also that pay-TV should be probed by the gress since it introduces a new of public service, warranting strontrol. Several members of the Harden committee concurred in this view, undoubtedly next winter will sefull-scale review of the subject.

EDITOR'S NOTE: For details on r type of "pay-as-you-see" televisystem see "Skiatron's Subscribers sion," page 58 of this issue.

In the meantime, the FCC has be requested by four ultra-high-charholders to approve the use of scription TV on their stations. Supplan, it was said, was urgently new now, for it would enable these bracasters to meet competition from a work stations operating on the standard bands.

Those who made the plea ince the Home News Publishing Co., Brunswick, WDHN-TV, Channels Pennsylvania Broadcasting Co., Pl delphia, WIP-TV, Channel 29; 88 ford-Norwalk Television Corp., Se ford, Conn., Channel 27; and Comticut Radio Foundation, New Hall WELI-TV, Channel 59.

COMMUNITY TV, another protectild, has appeared on the FCC del during the past few weeks. An accation has been received from Mountain States Telephone and I graph Company, in Denver, asking permission to build six microscopics.

NEW TV GRANTS SINCE FREEZE LIFT

Continuing the listing of construction permits granted by FCC sind lifting of freeze. Additional stations will be carried next month

STATE	CITY	CALL**	CHANNEL	FREQUENCY	POWE'I
Illinois	Champaign-Urbana		21	512-518	16.2
Maine	Poland Portland	WCSH	0	180-186 82-88	105 1
ď.	Lewiston	WLAM†	17	488-494	15.8
Massachusetts	Brockton		62	758-764	195
Mississippi	Jackson	WSLI†	12	204-210	214 :
Nebraska	Kearney		13	210-216	56.2
New York	Utica		19	500-506	52.5
North Carolina	Wilmington Winston-Salem	WMFD-TV†	6	82-88 204-210	53.7 316
Oklahoma	Oklahoma City		9	186-192	316
South Carolina	Greenville Spartanburg		177	66-72 488-494	100 I
Tennessee	Nashville	WSIX†	. 8	180-186	316
Texas	Midland Weslaco	KRGV-TV†	2	54-60 76-82	10 s 28.8
West Virginia	Fairmont	wvvw†	35	596-602	17.4
Virginia	Portsmouth	WLOW†	27	548-554	89.1
Alaska	Anchorage (Sharir	ng air time witl	2	54-60	13.8
u u	Fairbanks Anchorage	ag air timie with	2	54-60 198-204	13.8

**ERP= (effective radiated power, kw.). ..= Call letters to be announced \dagger = Temporary call letters.

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stations which would furnish view in Casper, Wyoming, and surround towns with signals from Denver Laramie. Distance between relay s tions near Laramie and Casper is o 100 miles, over mountainous terrain

The route described, which r parallel to an existing toll line, wo be equipped with alarm circuits to sure operation.

For over a year the Commission had a similar proposal from a gre in Poplar Bluff, Mo., who also w interested in erecting microwave lays to serve those in Kennett Poplar Bluff.

Since common carrier services involved, the Commission must be termine rates, classify types of soice, and consider too, if the relationship programs would create unfair c petition for those who might inst TV stations, as well as those who h already received permission to but

The Hinshaw proposal to amend Communications Act, placing all tyof charge service under a pull utility format, has also concerned Commission in this matter, and I probably delay consideration of f applications until Congressional act on the House measure is taken I

MOUNTAIN-TOP transmission, tured by scores of TV stations, highlighted recently in the approva Channel 8 to Mt. Washington, The official grant noted that the tion, with studios at Poland, Ma and transmitter atop towering; Washington, New Hampshire, serve a radius of 100 miles.

Maine found itself a headliness the TV station approval list as: summer came to a close with t grants; two for low-band and one the higher channels, or 6, 8, and as noted in the station table on :

MORE DOLLARS, to ease the TV application load, appeared in appropriations bill that was sig by the President.

Specifically, the Commission ceived \$900,000 more than it got the fiscal year '53. The addition cording to Senator Johnson, will r it possible to hire 14 more example teams to process applications. will give the Commission a total teams for the huge job of spee up grants.

ONE OF TV's greats, youthful 1 Farnsworth, received the plan of broadcasters recently during as quet in his home state, Utah.

Hailing the inventor, Harold E. lows, prexy of the National Assa tion of Radio-Television Broadca called him . . . "a giant among uses whose inventions have 1 modern-day television possible."

Farnsworth, who was born Beaver, Utah, was described as o of over a half-dozen basic TV pas used in practically every chassis, 1100 patents on electronic de-

ilzahs to this bold pioneer whose g resourcefulness has helped to new frontiers, bringing better ig to all

TRANSISTOR CATHODE FOLLOWER

By A. H. HELLMERS

itransistor equivalent of a cathfollower is the grounded-collecrcuit, more recently known as emitter-follower". The accommng circuit gives practical circuit mnts for a general-purpose emitlower using a Raytheon CK722 " junction transistor.

gain of this circuit was measat over 0.98, comparing very ably with tube circuits. The incimpedance is, however, much A Input impedance values, rangrom 100,000 to 200,000 ohms, were ared with several transistors of me type. In this type of circuit, input impedance is nearly equal e collector resistance, i.e., the mic resistance between collector dase. This dynamic resistance acw shunts the input circuit, as can en from the circuit diagram, and egeneration in the emitter cirncan do nothing to reduce this ging effect. The published value ollector resistance for junction oistors is usually around 10,000 but an operating point can use be found at which the collector mance is higher, as in the present

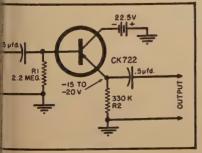
the input resistance can be measby inserting a variable resistor ries with the input and finding lial the value required to reduce cutput signal by half. The emitter or R, will require some adjustto get the highest input impedfor any particular transistor. The plan is to try several resistors ing from 1 megohm to 3.3 ohms.

utput impedance is around 10,000 s, and frequency response begins groop around 50 kc.

de battery current drain is about icroamperes. Most of the current through emitter load resistor R_2 , ce through the emitter, base, coler, and through the battery. Only tall fraction of the current passes ngh the base-to-ground resistor R_1 .

-30-

istor equivalent of "cathode follower."





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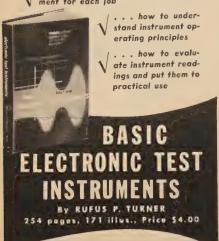
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Before proceeding with a description of such a unit, let us review some fundamentals.

Fig. 1A shows the basic voltage regulator circuit. The supply voltage must be approximately 20% in excess of the regulated voltage required, in order to cause the VR tube to fire.

The resistance R_1 is determined by the supply voltage, VR tube type, and current through the load R_2 . Thus, for a supply voltage of 250 volts, a VR150, and load current of 25 ma., and since approximately 5 ma. must flow through the VR tube to keep it fired, R_1 must be 100/.030 or 33,000ohms at more than 3 watts.

If the load is removed by opening S₁, the load current must flow through the VR tube. This value of current must not exceed the tube's maximum value permitted, usually 40 ma.

Referring to Fig. 1B it is seen that the load current must now flow through VR_2 whenever S_1 is closed.

If this load current is within the capabilities of the VR tube, a constant voltage drop appears across VR_2 and the voltage appearing at the load is less than that across VR_1 by this

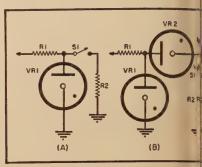


Fig. 1. (A) Basic voltage regulator cird (B) Another version of a voltage regula.

For example, assuming the va as calculated before, and VR_2 VR105, the voltage appearing ac the load is 45 volts.

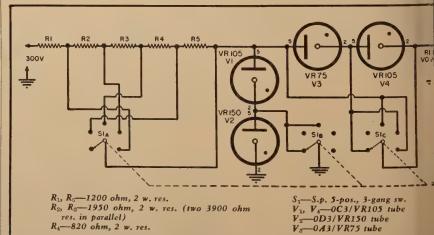
Note that the 45 volts is a r lated voltage. If VR2 is replaced a resistor of sufficient rating to the load voltage to 45 volts, the voltage will change with varying current, and cease to be a reguli

More than one VR tube mag added in series with VR_2 , further creasing the load voltage; more: tubes may be added in series : VR_1 , increasing the load voltage.

Now refer to Fig. 2 for the : matic diagram of the unit. In sys position 1 only two tubes are iri circuit, the VR75 subtracting the VR105, giving 30 volts output

Other switch positions give volv of 75, 105, 180, and 255. Maxic load current is 30 ma.

Fig. 2. Schematic of circuit which provides adjustable feature for power supply.



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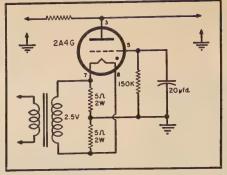


Fig. 3. Alternate circuit using a 2A4G.

Resistor values are shown for a 300 volt input, but by employing the relationships set forth earlier in this article their values may be calculated for any supply voltage.

Much more elaborate switching circuits may be employed with these and other tubes for a larger number of steps, but it was felt the steps shown represent a good compromise between complexity and versatility.

For those who wish to design their own circuits it should be pointed out that the 2A4G makes a good VR150.

A supply was built using three 2A4G tubes, a VR105, and a VR150, with the output variable in 15 volt steps from 15 to 300 volts.

Special connections for the 2A4G are shown in Fig. 3. Its major disadvantage is that separate filament windings are needed for each tube.

Another possibility for a VR tube is the common neon bulb. Current ratings are small, however. The NE-48 has a nominal current rating of 2 ma. and will maintain approximately 75 volts across it.

The useful life of these neon bulbs varies inversely as the cube of the current, consequently doubling the current reduces the life to one-eighth of the normal value.

As has been shown many times, a simple relaxation oscillator may be built using a VR tube circuit with suitable values of capacity across it.

Therefore a word of warning is in order. Do not exceed the value of capacitance across the VR tubes, as stated by the manufacturer, or unwanted oscillations may occur. For most VR tubes this is .1 μ fd.

For a simple to build, inexpensive unit, this circuit offers you a handy gadget for the work bench.

STATIONS JOIN NET

A.T.&T. has connected six more stations into its nation-wide network facilities. Stations WTVI, Belleville, Illinois; WGVL, Greenville, S. C.; KBES-TV, Medford, Oregon; WHB-TV and KMBC-TV, Kansas City; WBUF-TV, Buffalo; KEDD, Wichita, Kansas; and WETV, Macon, Georgia, are now tied into the network.

With the addition of these stations network programs are now available to 154 stations in 103 cities in the United States. This figure includes installations made by the Bell System up to and including August 24th.

<u>-30</u>



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105	.45	6CB6	.53	2BH7
1X2	-67	6CD6G	1.65	12SA7GT
304	.55			
GSGT	.63		.63	125L7GT 125N7GT
354	.50	6K6GT	.40	12SN7GT
3V4	50	6L6	.80	125Q7GT
5U4G		654	.43	L9BG6G
Y3		6S8GT	.67	19T8
5 Z 3	44	6SA7GT	47	25BQGGT
SAB4		6SD7GT	73	25L6GT .
AG5	54	6SK7GT	.47	25W4GT
AJS		6SL7GT	62	2576GT :
	.98		.62	3585
		6507GT	40	35C5
ALS		6T8	.73	35L6GT
AQ5		6U8	.78	
AT6	.35	6V6GT		357750
BAU6			46	3525GT
3AV6		6W4GT	-43	5085
SBA6		ewegt	.55	50C5
BA7		6X4	.39	50L6GT
SBC5		6X5GT		
BD5GT	.60	12AL5	.45	117Z3

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3	1U4, 354, 1S5, 1R5	7.80
	3V4, 1R5, 1S5, 1T4	
	11723, 1U5, 3V4, 1R5, 1T4	
6	12AT6, 12BA6, 12BE6, 35W4, 50C5	8.70
7	125A7, 125K7, 125Q7, 35Z5, 50L6	8.40

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WHEN IN N. Y. VISIT OUR STORE

PUNIM SURPLUS CON 316 CANAL ST. NEW YORK 13, I WORTH 2-1835 Color TV

ontinued from page 53)

phious transition from a 5-tube a 25-tube TV receiver. The ial 15 to 25 tubes required by dreceiver are, in some circuits, re of the same. However, in cuits there are new concepts, perstanding of which is essenhe proper diagnosis of trouble. present stage of color receiver ment, color adjustments are ply critical, requiring a broad dge of color circuitry. Service ans will have to study such conscientiously to be successhis field.

his point the writer would like a small prayer on the service ian's behalf. Knowing that Prvice test and alignment equipill be required in working with receiver let us hope that the irs of this test gear (it has been designed) will keep down e and weight. In the same tlet us pray that the designers e new color receivers allow for shooting in the home and in oinet. These larger chassis are trably heavier than black and chassis with half their tube ement. A combination of lighter ear and a chassis which could bubleshot" in the cabinet will or fewer ruptured service techi, fewer chassis dropped down tirs, and what is not a negligible in service technician-customer ns, smaller service bills.

article has attempted to dispel ig that has shrouded the color Considerable progress sicture. ren made in the formulation of sproved compatible color signal. applications for a "Change of have been filed with the FCC rst was made on June 25, 1953 A, and the second by the NTSC onth later on July 23, 1953. In ase a request was made to have present monochrome standards led to provide for color TV transns in accordance with the new signal. FCC approval is exby the first of the year or y thereafter.

eiver production should start v in the fall of 1954 with a price of \$750 to \$1000. This price is expected to fall as developal work continues. One laborahas already produced an experial receiver which requires only

t 2 of this series will discuss plor signal in detail and examine ical color receiver.

REFERENCES

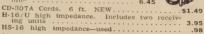
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essler, Robert: "The PDF Chromatron
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by 1953.

(To be continued)

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1.5 to 3.	*	PT3.33	34.95
			34.33
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Sky's the limit for SIMPLE SPEEDLAMP TEST

By ALLAN M. FERRES

This easily-built unit can mean more dollars for the shown owner. Servicing speedlamps is easy and quite profitable

SURE-FIRE operation of electronic speedlamps is imperative for both the amateur and professional photographer. This requires careful testing of the flash unit, especially after a repair or adjustment has been made or a new tube installed. One successful repair service operates the speedlamps two hundred times at their rated recharging time. If the light continues to operate during this test it can be assumed that it will function properly on the job. This service shop has the agency for a professional speedlamp which has a recharging time of 15 seconds. This simple tester was designed to perform this test automatically to relieve the technician of a monotonous and time-consuming task. Reliability and low cost were two definite requirements of the test unit, together with a reasonable interval accuracy. This device fulfills all three requirements adequately and is easy to build and operate.

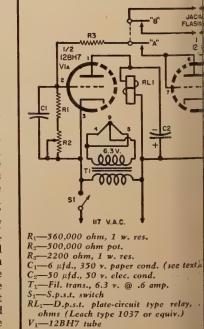
The speedlamp itself consists of a wet-cell battery operating a vibrator in the primary circuit of a high-voltage transformer. The high voltage is rectified and used to charge two high-capacity condensers in parallel. The switch on the camera shutter operates a relay which connects the condensers in series across the flashtube. When the flash unit is operating properly, the condensers can be fully charged in 15 seconds and are capable of firing the tube. If the tube cannot be fired in 15 seconds, trouble is indicated. What is needed is a set of contacts to take the place of the switch on the camera.

The test unit is built around a double-pole, single-throw plate circuit relay and a dual triode. The first triode section of the tube, $V_{1.4}$, has its cathode connected to one side of the 117-volt a.c. line; the plate, in series with the relay coil, connects to the other side of the line. The grid return is through R_1 and R_2 in series to the cathode. Across the two grid resistors is connected 6 µfd. of capacity, made up of a 4 \(mu fd.\) and a 2 \(mu fd.\) in parallel which were picked up on a "surplus" bargain counter. The other section of the tube, V_{1B} , is connected as a halfwave rectifier with the plate and grid tied together and connected to the arm of the "A" set of relay contacts. The cathode is connected to the line side of the relay coil. A 50 µfd., 50-volt electrolytic condenser is connected across the relay coil to prevent the relay from chattering on the pulsating d.c. R_3 , which is between the nonly-open contacts of the relay any grid of V_{14} , reduces the surge cut through the rectifier section and the relay closed long enough to positive action of the speedlamp of A 12BH7 was selected as the tubic its ability to stand a high negative on its control grid.

The operation of the circuit t tremely simple. When the test t first turned on, no bias is apple V_{14} , and when the tube has rem operating temperature, sufficient current is drawn to operate their and close the contacts. When the contacts close, about 150 volts s tive from V_{1B} are placed on the g V_{14} , cutting off the plate current charging C_1 . Cutting off the plate rent causes the relay to open. T lay remains open until C_1 han charged through R_1 and R_2 to 6 volts, the bias which will p enough plate current to flow tot the relay again. The cycle is the peated. The arm of the nors open "B" contacts of the relal connected to a jack suitable for lead which would normally conn the camera shutter.

The interval between the motary closings of the relay contact pends upon C_1 and the sum of K

Complete schematic of compact testet



maximum charging voltage on othe maximum bias which perough plate current to flow to the relay. After the tester is lip a piece of paper between contacts so that they won't and then plug it in to an a.c. When the tube warms up, the hould close. If it doesn't, ree spring tension and, if necesend the stop so that the armacloser to the pole piece. The hould close with a definite snap. to minimum resistance and pull er from between the contacts. lay will spring open and after 0 seconds close and open imely. With a stop watch or the chand of an electric clock, check igth of time between the relay ons. Increasing the resistance lill lengthen the interval. If the um interval is too short, inthe value of R_1 and if the miniinterval is too long, reduce R_1 . he original tester, a variation In 12 and 20 seconds was obwith the value of R_1 560,000 $(R_2, \text{ then, serves as a vernier})$ the exact timing can be easily he operating interval required. case, 15 seconds. If a much interval is required, such as nds or more, C1 can be changed

parts are mounted in a 6" x 6" eel utility box in any conveniangement, as lead length is not

. Do not connect any part of rcuit, except the jack, to the ase, as a severe shock hazard sult due to the direct connecthe circuit to the 117-volt line.

-30-

THAT WORD "HAM"

the "Short Wave Magazine" of nd, we reprint one of the recent om Jottings by the Old Timer," will be of interest to American

aders cannot have failed to notice e word 'ham' appears extremely in this publication. One of the no doubt, is that there is cera lack of dignity about that slang ation, and its traditional meaning apletely lost on the uninitiated, rgard a 'ham' in radio as being like a 'ham' in the acting profesam very strongly of the opinion e should make more use of the but only in very privileged cases.
spirit' used to be proverbial, emg all that was best and friendliamateur radio. Much of the tra-l 'ham spirit,' alas, has now been As a start towards reviving it, I at only the very best of amateurs be honored by the term 'ham,' should imply that a person so ated is one of the real 'good Most of us are only 'amateurs'

ateur radio, but a ham has prod beyond this stage; he gives his n every way he can, his behavior times is faultless, he never radi-bad signal, and he never makes a ce of himself in any way. There ry few of him about—are YOU



TRUE DISCRIMINATOR DOUBLE-UMITER HIGH-FIDELITY FM.

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When Approved's chief engineer showed us the prototype of this fine company's 1954 Model V-12, we contracted to buy the ENTIRE year's supply — the biggest special purchase of tuners EVER made by a single company. First, because V-12 is vastly superior to the previous Model A-710. Secondly, to eliminate middleman profits and save our many friends some REAL money. If you ordered an Approved A-710 from us and found, to your sorrow, we are sold out: NOW is the time to act. If you are considering buying a hi-fi tuner: NOW is the time to buy a reputable product from the East's best-known mail order company at savings NOBODY IN THE WORLD can duplicate!

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TUNER POWER SUPPLY ONLY \$12.05



110-115V 50-60 cycles; de-livers 6.3V AC @ 4 amps, 190V DC @ 55 ma. Size 3½" W x 4¾" H x 8" D. Ship. wt. 7 lbs. Built by Approved to match V-12 tuner! Order No. 36-207RN.



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AMP (P-2952)§	4.70
AMP (P-2953)8	5.44
750VCT/150MA/5V-3 AMP/6.3VCT-5 AMP	5.44
(P-2954) §	7.05
800VCT/200MA/5V-3 AMP/6.3VCT-5 AMP	
870VCT/250MA/5V-3 AMP/2.5V-10 AMP	5,23
6.3VCT-3 AMP/6.3 or 5V-3 AMP 80	
VOLT BIAS TAP (P-2956) \$	0.29
6.3V-2.7 AMP (P-3070)*	2 49
724VCT/295MA/5V-6 AMP/12.6VCT-5	2.43
AMP/51-2 AMP (P-3061)*	6.12
6 3V-6 AMP/6 3V-7 AMP/9 2165)+	2 50
800VCT/300MA/5V-3 AMP/5V-6 AMP/	0.55
12.6VCT-10 AMP (P-3166)‡1	7.64
1750V/2MA/2.5V-2 AMP/6.3V9 AMP/	. 47
2500V/5MA/2.5V-2 AMP/6 3V-3 AMP/	5.17
6.3 or 2.5V-3 AMP (P-3171) §	8.23
800VCT'.200MA/5V-3 AMP/6.3VCT-5 AMP (P-2955)\$ 870VCT'.256MA/5V-3 AMP/2.5V-10 AMP 6.3VCT-3 AMP/6.3 or 5V-3 AMP 80 100VLT-3 BMA 5TAP (P-2956)\$ 100VLT-3 BMA 5TAP (P-2956)\$ 100VLT-3 AMP/6.3V-10 AMP/6.3V-2.7 AMP/6.3V-10 AMP/6.3V-10 AMP/6.3V-10 AMP/6.3V-2.7 AMP/9.301)\$ 124VCT'.295MA/5V-2.0MP/5V-3 AMP/6.3V-6.3V-6.3V-6.3V-6.3V-6.3V-6.3V-6.3V-	ount
HYTRON TEST ADAPTERS 7 pin minature. \$ 8 pin octal. 9 pin minature.	
8 pin octal	2 30
9 pin minature	1.42 2.30 1.70
HYTRON TOOLS AND AIDS	
Tube Lifter	.14
Soldering aid	.48
Tube nuller	.34
7 & 9 pin straighteners	.54
Tube Lifter Soldering aid Probing tweezers. Tube puller 7 & 9 pin straighteners. HYTRON POINT CONTACT TRANSISTOR PT-2S. 1 PT-2A. 1 T-2 socket. SPECIALS	25
PT-2S	7.40
PT-2A 1	7.40
1-2 SOCKET	.30
No. 14 enamel 100 ft. soil	0.5
No. 12 enamel 100 ft. coil	.95
No. 10 enamel 100 ft. coil.	2.45
NE-40 3 watt neons	.38
NE-2 neons with leads	.19
100-1/2 watt resistors (asst'd)	1.00
6VDC to 110 VAC 40 wire wd rheostat	.58
SPECIALS No. 14 enamel 100 ft. coil. No. 12 enamel 100 ft. coil. No. 10 enamel 100 ft. coil. No. 10 enamel 100 ft. coil. NE-40 3 watt neons. 2½ watt argons. NE-2 neons with leads 100—½ watt resistors (asst'd). 25W—150 OHM wire wd rheostat. 6VDC to 110 VAC—40 watt supply	9.95
Prices F.O.D. our warehouse New Y	ork
IEERC DARIO	
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75 Yesey St. Dept. A New York Cit	y 7
	_

The "Fold-a-Flex"

(Continued from page 67)

of enclosure by closing Ports A a to position S-S. The reflex Port also completely closed. Approxim 11 cubic feet are provided for o tion as an infinite baffle.

Bass Reflex

Well designed bass reflex cat are capable of excellent results. manufacturers provide such cal to accommodate their loudspea However, they sometimes compre between optimum performances space requirements because not customers will tolerate a cabini large as is necessary for best poo results. The "Fold-a-flex" providalternate choice of two cabinet umes.

Bass reflex performance is obti in the "Fold-a-flex" by closing A and B in positions S-S and by ing the port for correct reflex a Details on this tuning will bel cussed in a subsequent article! port is placed close to the loudspa opening so as to take advantage radiation impedance (in-phase s taneous compression of the air tween the two openings tends tot force the transfer of energy t air).

Folded Horn

Various types of corner can have achieved great popularity a cent months. The "Fold-a-flex" braces a true folded horn when r A and B are placed at position and when reflex Port C is close tuned in conjunction with the characteristics. By placing the e ure in a corner, two walls of then will extend the effect of the horn. When placed against a flats there is sufficient horn loading t vide very clean response well t 50 cycles. It is entirely possils combine the bass reflex principle the folded horn design.

Construction

The dimensions shown for the's a-flex" are typical for 15-inch: ers. Kimsul blocks are placed a dom throughout the inside of the net walls to prevent standing ! within the cabinet. Two inch E is placed at the apex of then within the cabinet directly back speaker. Braces of 1X2's may b ed at random angles within the net to offset cabinet resonances encies.

The partitions extend the full height of the enclosure and these be % inch plywood. The main c structure and the removable baffle are constructed from % plywood. Gaskets are used & Ports A and B to insure an a seal.

Two vertical slots are located cent to the front mounting baffle

RADIO & TELEVISION

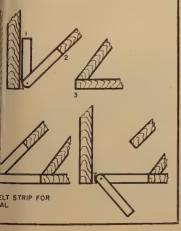
repiece of plywood shown in aings may be moved up and ictly back of the reflex Port by loosening the two knobs, e port, and then tightening which permit the slide to ly held in any chosen posiars imperative that any reflex be tuned to the speaker for results.

sproved model of the Read Jex" utilizes a modification of and B as shown in Fig. 2. the hinged edge of the ports ded and that a 1/8 inch felt Mued to the inside of the cabing as an air seal regardless sition of the ports. This techgo provides a braking action the ports in any chosen po-Modified Ports A and B are ed like a "V" and the followin results: when set in Posihe characteristics of the enwill be that of a folded horn. Position 2, the air volume of met is decreased to provide loading for the cabinet when a bass reflex and also to pro-Her characteristics for 12-inch $^{\prime\prime}$. When Ports A and B are t Position 3, the total air vol-Ithe enclosure is available to an infinite baffle characterms a reflex using large air vol-

If the modified construction of is does present a greater conn problem, it will be well ne effort for the experimenter nom installer as it will provide jest possible choice of baffle cristics for the demonstration stidelity equipment. With these ole ports at your fingertips aker characteristics can be ol to create the most pleasing

equent data will appear giving ails for construction of this endesign for both 12-inch and speakers including the coaxial as two- and three-way speaker Measurements are now being n several representative speakperformance curves will aplater issues.

An experimental model of the "Foldwith a modification of Ports A, B.



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 Im
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- 40:1 Geared Ratio Dial Drive 11 Tubes Plus Selenium Recti-
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 GSB7Y Mixer
 2-6SG7 I.F.
 6H6 2nd Det &
 N. L.
 GSF7 AVC AMP.
 GSL7 BFO &
 1st Audio
 GSL7 Phase
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- Audio Gain
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- BF0 Pitch
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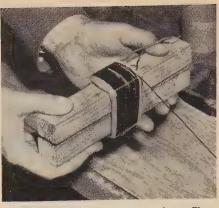


Fig. 1. Winding the new secondary. The block of wood prevents damage to wire.

USE YOUR DEFECTIVE TO TRANSFORMER

By

HENRY A. SETZKE

Discarded components can be utilized to build this hand

variable voltage transformer for service shop test work

THE piece of equipment to be described should be standard equipment for every service technician. It is as necessary when testing television receivers as when servicing a.c.-d.c. radios and the like. The variable line voltage transformer can be used to test for voltage-surge intermittents, excessive bleeder resistance drops, and many other defects. It is also useful for isolation purposes. The particular unit described here can be constructed from any ordinary defective TV power transformer.

The power transformer from a TV set is desirable because it is designed to supply 250 to 300 watts and therefore is capable of delivering this much power after it is rewound. Most defects in TV power transformers occur as a shorted or open high voltage winding. The transformer selected must have this type of defect because all the windings except the high voltage one will be used again.

The first step is to disassemble the core. While removing the core laminations carefully observe the way the core was constructed; later it must be replaced the same way, see Fig. 2. Care should be taken when removing the laminations so that they are not bent or damaged in any way.

The second step is to remove the defective high voltage winding without disturbing the other windings. The high voltage winding will be the winding with the smallest diameter wire. All insulating paper should be saved for later use.

If the high voltage winding is the outermost winding it should be removed up to and without disturbing the insulation which separates the high voltage coil from the next coil. The new secondary can then be wound directly upon this insulation using the inner coils as a coil form. A block of wood one foot long through the center of the coil will make winding easier and also prevent damage to wires from the other coils during the winding process. See Fig. 1.

If the high voltage winding is the

innermost coil a slightly diffi procedure must be followed. The are always wound upon a heavy board form; since the cardboard will be used with the new coil,i should be taken when removing single cut with a razor blade or knife should be made, and the board form carefully removed. ! the high voltage winding is remove to the insulation that separatethigh voltage coil from the next A block of wood about one foot and the same dimensions as the side of the cardboard form, will \ winding the coil easier. Two or pieces of wood may be used to go desired size, see Fig. 1.

The third step is to determine number of turns needed for the secondary. After the high vowinding is removed the "volts secondary-turn" can be determine by temporarily winding 10 full of #18 enamel covered magnete around the windings that are left temporarily replacing the correcterial. Connect the primary the line and accurately measure the age of the 10-turn winding. "volts-per-turn" is this voltage vided by 10.

The number of turns for the secondary coil can be determined dividing 120 by the "volts-per-tabout 125 feet of wire will be quired. The coil can be wound either direction, but when once state direction of winding should be secondary to the direction of winding should be secondary to the direction of turns for the secondary contains the direction of turns for the secondary could be secondary to the secondary could be secondary coil can be determined by secondary coil can be sec

Fig. 2. How transformer core is disasses



langed. A thin layer of insulatpaper should be placed between



3. Over-all view of unit showing comisize. A meter can be added if desired.

The coil should be tapped at rolts from the end. The number airns from the end where the tap ld be placed can be determined lividing 10 by the "volts-per-turn." tap is twisted together, insulated, the remaining wire wound over it hown in Fig. 1. After the new is wound on the cardboard form, hating paper should be used to il up the size so that it fits firmly de of the old coils.

ne fifth step is to connect the sectry windings in series aiding and ring the connecting points out to a ch. (See Fig. 4.) If there are more sndaries than the customary 6.3 and 5 volt windings more taps be added. With the minimum ber of secondaries the circuit ıld be wired as shown in the cirdiagram, Fig. 4.

help connect the secondaries perly, an a.c. voltmeter should be l. If it reads 113.7 volts when the c volt and 6.3 volt windings are ed in series, it means the windare in series opposing. To corthis interchange the 6.3 volt

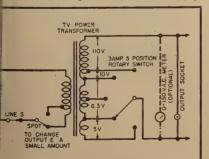
es. The voltage should then read 3 volts. The same procedure is bwed with the 5 volt winding.

0-150 volt a.c. meter may be coned across the secondary of the asformer as shown in Fig. 4 to give ontinuous indication of the secondvoltage.

iaking into account the small outof cash and time required to build unit, this is a worthwhile project n every standpoint.

-30-

4. Circuit diagram of junk-box supply.



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MICA CAPACITORS					
FIG. A	UPRIGHT MOUN	NTINGS			
MFD. Ea.	MFD. Ea.	MFD. Ea.			
1000 V.	2500 V.	.0000695			
1000 V.	.025 2.25	.0000595			
.1\$1.00	.00075 1.50	5000 V.			
.07	.0006 1.50				
.06290	.00025 1.25	.004 3.50			
.05		.002 3.25			
	3000 V.	.0015 3.25			
1500 V.	.006 1.50	.001 3.25			
.075 1.25	.005 1.50	.0008 3.25			
.05 1.10	.004 1.50	.00075 2.75			
.039 1.10	.003 1.50	.0005 2.75			
	.002 1.50	.00045 2.35			
	3000 V.	.0004 2.35			
2000 V.	3000 V.	.0002 1.75			
.03 2.25	.001 1.35	.00009 1.50			
.01 2.00					
	.00055 1.25	7500 V.			
	.0005 1.25	.0005 3.95			
.005 1.50	.0004 1.25	8000 V.			
.003 1.25	.00025 1.25	0000 V.			
.00275 1.25	.0001 1.15	.01 5.95			
.0025 1.25	.00009 1.10	.0006 4.50			
00123 1.00	.00008 1.00	.0005 4.50			

MICA CARACITORS

00127 1 00	.00008 1.00 .000075 1.00	.0005 4.50 .00025 3.95
0.00		ERMINAL
500 V.	1200 V.	2500 V.
.05 1.00		.015 1.60
	.02	.01 1.50
	.01	.004 1.25
.02		.0035 1.25
600 V.	.00165	.003 1.25
	.00550	.002 1.00
	1250 V.	.0018 1.00
		.0015 1.00
		.0006390
	.02585	.000690
.02	.0180	.000590
	.00660	.000485
	.004	.0002585
.0000535		.0001585
1000 V.	2000 V.	.0000575
.01	.0004	3000 V.
.0000550		.005 1.50
.00003		

FIG. C. SOLDER LUG. TYPE

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190 to 550 KC \$16.95 6 to 9 MCS. 9.95

TRANSMITTERS 4 to 5.3 MCS. 8.95 5.3 to 7 MCS. 7.95 With all tubes and crystal. In excellent condi-

tal. In excellent condi-tion.
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Complete with all tubes and dynamotor. Excel-lent condi-

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Single Trans. \$1.00 Ea, Triple Frams. \$1.75 Ea, Triple Frams. \$1.75 Ea, Re-2ARC-5 ANTENNA RELAY UNIT Comp. with Meter and

AY-5 Type, same as above but has a continuous \$4.95 rotating shaft. These compact units are all new \$4.95

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1.000 V. 1.95 | 1 MFD. 1500 V |
1.000 V. 1.95 | 4 MFD. 1500 V |
1.000 V. 1.95 | 1 MFD. 1500 V |
1.000 V. 1.95 | 1 MFD. 1500 V |
1.000 V. 1.95 | 1 MFD. 2000 V |
1.000 V. 1.95 | 1 MFD. 2000 V |
1.000 V. 2.25 | 3 MFD. 2000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 3000 V |
1.000 V. 2.95 | 1 MFD. 5000 V |
1.000 V. 2.95 | 1 MFD. 5000 V |
1.000 V. 2.95 | 1 MFD. 5000 V |
1.000 V. 2.95 | 1 MFD. 5000 V |
1.000 V. 2.95 | 1 MFD. 5000 V |

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INC.

The OARAC (Continued from page 83)

linder passes under a magnetic head only once for each revolution of the cylinder, it is not possible to read any arbitrary spot at any arbitrary time. It may be necessary to wait up to a full revolution before the desired spot passes beneath a magnetic head. Since the cylinder rotates at 3350 rpm or approximately 56 revolutions per second, one revolution takes 1/56 second approximately 18/1000 which is 18 milliseconds. This is the maximum access time for the memory. The waiting time for the desired spot (or more properly "word" since a full word is always read at one time) to be read may vary from zero up to the maximum access time of 18 milliseconds, hence it is useful to speak of the average waiting time. This is just ½ the maximum access time, thus we say that the average access time is 9 milliseconds.

Turning away from the OARAC memory our layman encounters a large cabinet filled with vacuum tubes, germanium diodes, and associated electronic components not to mention an almost undecipherable maze of wires. The contents of this cabinet are primarily the arithmetic and control circuits of the computer. In spite of their electronic complexity, the basic functions of these circuits are quite simple. Let's consider the arithmetic unit first.

The arithmetic unit is that part of the computer which does the arith-

metic calculation. It may be d pared to a very high-speed desk culator which is capable of adding ten-decimal-digit numbers in at 90/1,000,000 of a second, or in c puter language, 90 microseconds. multiplication of two such number takes approximately 8/1000 second 8 milliseconds.

The main components of the ar metic unit are three storage regist an adder, and a counter. The stor registers are electronic circuits (e contains 44 tubes plus 352 german diodes and associated componen each of which is capable of stor one ten-decimal-digit number, or w as it is sometimes called. These isters are used to store numbers t porarily while the arithmetic opn tions are being carried out. The acc may be compared to an electronic i dition table. When electrical signing representing two numbers are feet its input an output signal represe ing the sum of the two numbers . pears at its output terminals. Wi the adder is properly connected to of the three storage registers, numbers stored in the registers added and the sum is stored in on) the registers. Subtraction is acco plished by first making one of f numbers negative and then ado

Multiplication is accomplished. means of repeated additions. For ample, $7 \times 3 = 21$ may be write 7 + 7 + 7 = 21. Using this metal multiplication makes use of the acand the counter is used to keep to of the number of additions that This is a somewhat simpli

Close-up view of plug-in turret used



of how the computer actually ies, but it serves to illustrate vic principle involved.

control circuits of OARAC may ded into two parts-the arithmontrols and the sequencing cir-The arithmetic control circuits he necessary signals to the tetic unit to cause it to add, t, divide, etc. as required. The ucing circuits are the real heart computer. It is this part of chine which governs the autooperation and so to speak " the rest of the computer.

cre a problem is turned over to for solution, a mathematician preak it down into a series of steps such as additions, multions, etc., which the computer recute. The computer is told y out each of these steps (and al problem might have several nd steps many of which the ter repeats hundreds or even ands of times) by means of an etion for each step. An instrucis essentially a code number Itells the computer what to do. cample, 220005 is an instruction the computer to add (code 22) (mber stored in the memory at space 0005 to the number alin the arithmetic unit. When loblem is put on the computer, (t of instructions together with cessary numbers is stored in the Each instruction or number PV. ed at a specified address in the v. (The word spaces in the y are all numbered and these are called addresses.)

ir the problem is stored in the y the computer is placed in ion from the control panel by ging the address of the first in-

on to be executed.

sequencing circuits send out the ary signals to cause the first ction to be read from the ry. When it has been read back the memory, the sequencing cirinterpret it and send out the vary signals to the arithmetic ol circuits to cause them to exethe instruction. After the inion has been carried out, the netic control circuits send a sigack to the sequencing circuits. the sequencing circuits receive ignal they automatically cause ext instruction to be read back the memory, interpret it, and the proper section of the arithcontrol to carry it out. This continues at a rate up to 100 ctions per second until an inion to stop is reached, or until ror which causes the computer p is made. The computer is so that it automatically detects of the errors which it occasionnakes and automatically corrects of them. If the computer canprrect its error by repeating the itation it stops and signals the tor by means of an alarm bell. perator then corrects the trouble -30estarts the computer.

FAMOUS B-29 **BOMB SIGHT**

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C'anta	Transmitter rack 1.59	3.25
Single	Transmitter rackittition	

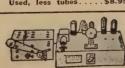
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PE-94	28	300	@ .2		
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DE 102 DV	NAMOTOR	6/12	V inpu	t. 600 V	@ 160

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ATTENUATOR SWITCH AN ELECTRONIC METRONOME

By LEON A. WORTMAN

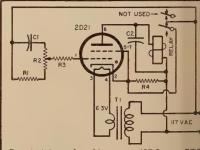
A simple instrument with an adjustable rate. The noise of relay closing marks beats.

F YOU haven't raided the "junk box" yet for the fun of building an electronic metronome, here's a circuit that's quick, foolproof, and easy. If your daughter, son, niece, or nephew is at the piano-lesson stage, here's a metronic device (electronic metronome) that the teacher will approve. If you're a storekeeper with space for animated displays, this same device will provide automatic "stop-go" control for lights, motors, and solenoids.

The circuit uses a 2D21 thyratron tube as the gating control for the heavy duty relay. Action time for the gating control is determined by the values of R_1 , R_2 , and C_1 . Variation in the timing is afforded by making R_1 or R_2 or C_1 variable. Of course, it's not practical to make a .25 µfd. condenser variable. It is very simple, however, to make R_1 or R_2 the variable element. A wider range of time control is available by making R_2 , the larger of the two values, the variable. A standard carbon-type potentiometer is ideal for the purpose. The acoustic sound made by the mechanical and instantaneous action of the relay creates the sound of the meter of the tempo. R_3 serves as a grid current limiting resistor. It can be eliminated but would shorten the life of the 2D21. C_2 eliminates relay chatter and contributes to smooth positive relay action. The simplest method of calibration is to beat the acoustic sound against a mechanical

For use as an animated disply "stop-go" control, the spare set of s.p.o contacts on the relay can be wired series with the electric motor, light or solenoid of the display.

The size of the box in which t unit is constructed has no bearing the performance. However, the smi number of components and their small sizes enables compact construction a a more attractive appearance. The a thor's unit is built in a 21/4 x 21/4 x inch aluminum box.



 R_1 —330,000 ohm, $\frac{1}{2}$ w. res. (IRC type BTS) R_2 —1.5 megohm linear-taper pot (IRC type PQ)

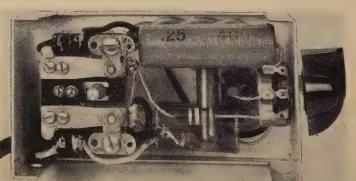
 R_3 —1000 ohm, $\frac{1}{2}$ w. res. (IRC type BTS) R_4 —5000 ohm, 10 w. res. C_1 —25 μ fd., 400 v. tubular cond. (Sangama

type 30)

 $C_3 = 2 \mu f d.$, 450 v. elec. cond. (C-D type B 245) T1-Fil. trans. 6.3 v. @ 1 amp. (Thordarso

T21F08 or equiv.)

Relay—Heavy-duty relay, 5000 ohm coil, 111 volts d.c. (Allied Control Co., Inc.)
1—2D21 thyratron



Circuit diagra of the home-mor metronome. 2D21 thyratron used as a gate control for rela

Under chas: view of unit. I. housed in a 2 x 21/4" x 4" (minum cabini

TV Tube Substitutions

(Continued from page 50)

by out the rivets other parts be damaged, the rivets may be essible, etc. In those instances possible to wire the new socket into the old one by filling the ples of the old socket with solder meonnecting the new socket with lengths of bus bar. To avoid ics, cover the bus bar with insuse sleeving.

le of the things to watch when Mituting tubes is the heater or required. In most TV sets us-3.3 volt heater tubes, the extra or needed by a substitute can usube supplied by the transformer but substantially lowering the Fr voltage. Where a series heattring is used, a substitute tube paring more heater current or er voltage cannot be connected.

If the substitute takes less current, a shunting resistor must be added.

Many of the 6.3 volt tubes used in TV receivers have 12 volt equivalents such as the 6AU6, 6AT6, etc. and their 12AU6, 12AT6, etc. brothers. Since these tubes are identical in all but the heater voltage and current, the 12-volt types are not listed here. There is little chance of substituting, for example, a 12SN7 for a 6SN7. On the other hand, a 6AT6 can be substituted for a 6AV6, similarly a 12AT6 can be used in place of a 12AV6. The series heater equivalents for other TV tubes, such as the 19BG6 for the 6BG6 etc., are also omitted for the same reasons. The 6-volt equivalents may be used for 12-volt tubes which have center-tapped heaters (12AU7, 12AX7) paralleled across 6.3-volts.

Keep this tube substitution list on hand to use as a quick reference when a particular tube type is out of stock and also to show to the customer what substitutions can be made. -30-







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5000 v. range on both AC and DC?	YES	Yes	No	Yes	No
AC/DC sens: 1000 Ω /v.?	YES	Yes	Yes	Yes	No
DC and AC Current Ranges?	YES	No	No	No	No
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TVI COMMITTE

A N OUTSTANDING example of a pr lic service being rendered by an an teur radio group is the Washington Te vision Interference Committee (WTVI operating in and around Washingto

The committee was formed in Ap-1952 to combat television interferent Representatives from each of seven act amateur radio clubs in metropolit Washington, D. C. were organized in one coordinated committee of technic and public relations experts.

In order for the program to open most effectively and on a mutual sistance, cooperative basis with other ganizations interested in communications tions problems, the committee mainta close liaison with associate agencies sr as RETMA, NAB, Electric Institute by Washington, Telecasting Services, FO MARS, and the power companies.

The prime purpose and function this public-spirited committee is to p vide diagnostic and technical assistan for amateurs involved in television int ference problems and, at the same tirt to develop and maintain good neighborhood relations between amateurs a television set owners.

The ultimate success of the commit plan will depend, to a great extent, up the degree of support and cooperate extended by manufacturers of televisit receivers and their service techniciai in applying corrective measures to ceivers which respond to signals outs of the television band.

WTVIC has striven to create first atmosphere of continuing mutual derstanding and interest between amateur and service technician and s ond, to promote an acceptable "edultional" program for TV technicians developing the most effective and e cient approach to the solution of TVI problem in general.

In line with this thinking the co mittee has issued a poster and a pamy let for distribution among service shell and their personnel in the Greater Wal ington area.

The pamphlet, prepared in cooper tion with RETMA, outlines the proble explains the amateur's role in TVI coplaints, the use of filters, and solid the cooperation of manufacturers handling the problem.

The poster, entitled "Television Inference Aids," has been prepared WTVIC, RETMA, and the FCC. It is

ing published and distributed as a p lic service by the Electric Institute t Washington. The poster lists 1 causes, effects and solutions and give circuit diagram for a high-pass filter a 300-ohm receiver input, a chart of oscillator settings for 20-30 mc. and a 50 mc., as well as other service tipsp value to the technician.

Widespread distribution of these p ers plus the many favorable reports the committee's work have done mu to alleviate TVI problems and their c sequences in the Greater Washing

Chairman of the WTVIC is M Loria, W3IZL, 5131 70th Place, La over Hills, Maryland. Other amat: groups interested in setting up a simi committee should contact Mr. Loria further details.

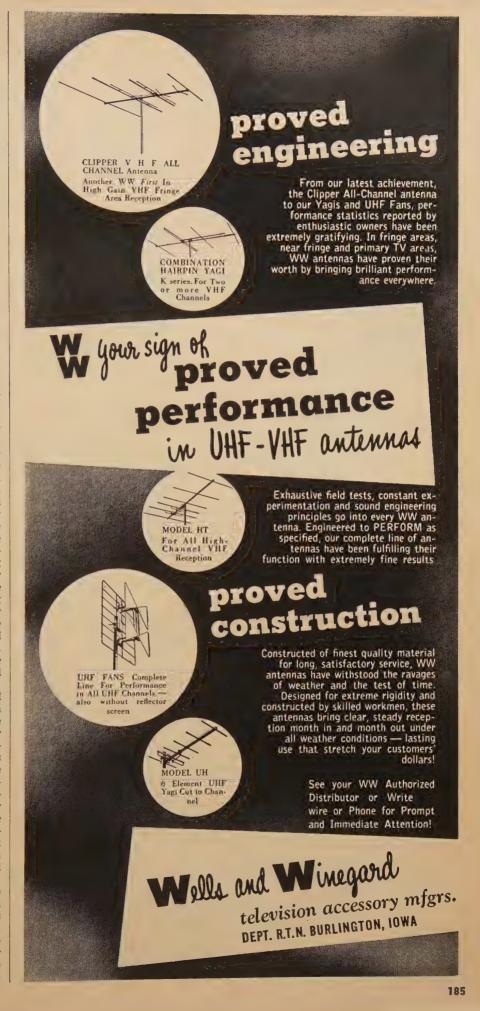
regenerative Receiver in the following from page 77)

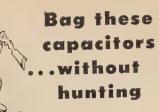
er shaft and the dial serves portant purposes: to compenint, and to prevent stresses apthe dial or panel from being stted directly to the condenser tuning it. Insulating washers uired in mounting the phone to ce neither side is grounded.

boil diagram shows the details construction. The broadcastwil is made from a broadcast anoil (J. W. Miller Co. No. 20-A) ing the tickler coil (wound on cardboard tube). The assemits attached to an old octal tube aving all eight pins, using small We screws and the mounting that was on the coil. The cicturer's markings were for both the primary and the bils; that is, the terminal for d connection was grounded and pund connection fed to the grid, The builder will find that the y is wound on its own short which slides over the grid coil. is intended to be cemented in sition desired by the user. For ceiver, it should be cemented in Jwith its center 3/8" from the 11 (terminal or lug end) of the oil. The tickler is wound with ns of No. 28 enameled wire on m made of a piece of cardboard of large enough inside diameter tightly over the very end of the frast coil form $(1\frac{1}{16}")$. Some and trouble in finding the rightform can be saved by purchasing "slip-over issner No. 14-6852 which costs twenty-five stripping the original winding it, and using this as the tickler Wind the tickler and cement the together so that the tickler and windings are about 1/8" apart. plugging in or removing the eted assembly, the fingers should

short-wave coils were wound siller No. 74002 coil forms with 8 enameled magnet wire. The ion of winding was the same for of the three coil elements, prigrid, and tickler. Small holes drilled in the spacers to provide its best to coat each coil elewith polystrene coil dope after ng it and before winding the element of the coil. If any adient of the coil is required, it probably be on the tickler, which und last. This part can be doped

ter the wiring is checked and the ries connected, it is a good plan easure the voltage between pins 1 8 of each tube, or to test with all flashlight bulb before inserthe tubes. If any voltage other 1.5 volts were placed on the ents as a result of incorrect wir-





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ing, the tubes would, of course, burn out instantly.

The standard parts lists that go with circuit diagrams in the usual construction article show only electrical parts, so to save the beginning student some trouble in selecting mechanical accessories they will be mentioned here. The front-view photograph shows a vernier dial; either of the National types B or BM would be suitable. A standard phone plug should be purchased for the headphones, as they will come with phone tips, now seldom used. The frontpanel jack for them should be of the open-circuit type. Three tube sockets will be needed, two loctal and one octal. The open-ended chassis is a Bud CB-41. The flexible coupling for the condenser shaft is a National TX-22. Similar units of other makes may be used. The purchase of a spool of #28 enameled wire and of a bottle of polystyrene coil cement or "dope" was implied earlier. Use rosin-core "radio" solder; do not use acid-core solder or soldering flux in this application. Even slight corrosion in a radio joint can ruin the performance of the equipment.

Operation

The detector is put into oscillation by turning the regeneration control in the direction of increasing capacitance. The appearance of oscillation is marked by a soft hiss if the control is turned slowly, or a click if it is turned more rapidly. Tune for weak signals with the set just oscillating until a signal is heard, and then "back off" the regeneration control. Greatest regenerative amplification is obtained at the point just before the detector starts to oscillate. Strong signals, particularly on the broadcast band, are best tuned in with the set not oscillating. The c.w. signals are received with the set oscillating, and the point of greatest sensitivity is just beyond the point where it starts to oscillate.

If the set does not oscillate properly, the wiring should be checked again. and particularly the tickler connections. A common cause of failure of a set to oscillate is reversed tickler connections. If the set does not oscillate at the low frequency end of a tuning range (condenser plates closed), the maximum available feedback is insufficient. This condition may be corrected by winding additional turns on the tickler coil. On the other hand, if oscillation cannot be stopped at the high frequency end, turns should be removed from the tickler. Sometimes oscillations may fail over a short interval in the tuning range. Such "dead spots" are due to resonance effects in the antenna and may usually be cured by inserting a small condenser, 100 $\mu\mu$ fd. or less, in the antenna lead.

"Body capacity" is a common ailment of short-wave regenerative receivers when the antenna is coupled directly to the detector. This is a



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How to build and play my latest model eletronic organ without a knowledge of music. get blueprints for a miniature electronic breand other projects for electronic construction Send 3c stamp for air mail reply.

JIM KIRK, W6DEG, 1552 Church St., San Francisco 14, Cal. ain in which the operator may slight change in frequency or mation by touching the receiver the leads. It is caused by the at the operator becomes part antenna circuit and alters its al characteristics. We had grouble from this source above but were able to eliminate all of it by moving the reto a location where a short tion to a radiator ground could 1. Other methods which may be robe in individual cases are: ina small fixed or variable conin the antenna lead, loosene antenna coupling, bypassing none leads with a condenser 0.001 or 0.002 μ fd.), or grounding separate points.

he receiver is located too near ong station on the standard ast band, difficulty will probde encountered in tuning it out tely. Although the receiver high selectivity when the regencontrol is advanced, a very signal tends to "tail off" over siderable portion of the dial. only real remedy for this difwould be to use more tuned cirbut then we would be dealing different type of receiver alto-. By careful tuning to the exact (ncy of the desired signal, the of the strength of the two sigynay often be made such as to cally eliminate the interference. ocal reception, all but three or weet of antenna may be discond and still leave enough sensitor good results. Various wavecircuits may also be used.

etttle skill is required to tune a crative set properly, but an eveor so of patient effort will rethe constructor with many hours soyable listening.

Transistor Timer (Continued from page 69)

or a specific short interval (as warming solutions). Where a ng element or other piece of ment requiring large current is care must be taken that the mum current rating of the relay acts is not exceeded.

Il another application is in conng a tape machine or record r so that a specific commercial age may be delivered when the et" button is pressed. A typical ple would be in the display room convention or show. When a rby presses the button, a tape back machine operates for a speperiod of time, giving any desired age or "sales talk."

similar application is in the oper-

of mechanical displays.

e reader can undoubtedly list y other possible applications of timer. Then, too, once the builder had a chance to experiment with completed unit, other possibilities occur to him.

DRUGSTORE COIL FORMS

By WM. BRUCE CAMERON, W8IVJ

AN EXCELLENT coil form for many purposes may be found at most drugstores in the form of a small plastic vial, used for pills, capsules, etc. These come in a variety of diameters and lengths, are hard transparent plastic, fitted with flexible plastic caps.

They appear to be good r. f. material, judging from the ones I use in my grid dipper and v. h. f. gear. For receiver and transmitter use, the caps may be fastened to the chassis with a machine screw, and the pre-wound coils slipped in and out easily. These are excellent for grid-dippers, since the flexible caps can be fitted with banana plugs and will take rough handling without breaking.

Since the forms are transparent, data on the coils, such as frequency range, can be typed on a slip of paper and inserted in the forms before sealing, giving them a truly professional appearance. Caps and vials may be permanently joined with "Duco" or similar cements. Prices will vary with size and with the druggist, but will run around fifteen cents—less than many commercial forms.

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You can do MORE LINCOLN TUNNEL TRAFFI

CONTROL

Traffic snarls are rare and relatively painless thanks to "Message-Repeater" unit.

A TINY cartridge, smaller than a man's hand, is playing an important role in meeting emergencies in the Lincoln Tunnel, linking Manhattan and New Jersey.

Since January 1952, the south tube of the tunnel has been equipped with a radio transmitter. As motorists enter the tube from Weehawken, N. J., they pass under a large sign which reads, "Lincoln Tunnel Radio—500 on Your Dial." By tuning in that frequency they receive music and messages to make the under-river trip faster and more pleasant.

Between musical selections, the tunnel radio advises drivers to relax in their cars if they should have a breakdown or a flat because the Port Authority will move the car safely and quickly without charge.

and quickly without charge.

In cases of emergency, a special cartridge is inserted in the "Message-Repeater" alongside the transmitter and the appropriate warning is transmitted to the drivers. Each cartridge bears a pre-recorded message prepared by a professional announcer to meet varying situations. Utilizing the canned message frees one tunnel officer from the task of making vocal an-

The master control unit of the Lincoln Tunnel radio system with the "Message-Repeater" unit at right. Pre-recorded messages can be transmitted at will.

Sgt. J. Knight of the N. Y. Bridge and Tunnel Authority inserts a cartridge containing a pre-recorded message in repeater. Message is on endless tape.



nouncements when anything governous. If anything occurs which is covered by a prepared tape, the the nel officer in charge can speak in the "Message-Repeater" through; hand microphone and instantly received a message to meet the new condition

Officers at the control tower in tunnel are enthusiastic over the s cess of the operation. They are h ing that funds will soon be availal to provide a similar setup for third tube which is now under a struction and they would like to the system extended to the highway which feed the tunnel. As one office explained, "When the cars get h there isn't much we can do exce explain the reasons for the tie-up, if the radio were extended to highways we would and could che nel traffic to other of the cross-rin routes when we're tied up."

The tunnel radio system was a veloped and installed by *Touradio* in of 25 Vanderbilt Ave., New York, NI and the "Message-Repeater" unit is product of the *Mohawk Business I chines Corp.* of 47 West Street, NYork, N. Y.

-30-



Electronic Shipyard

ontinued from page 57)

dage according to the space ocwy equipment.

arrange to work on boats in rather than as single "strays' d there, so travel costs can be In removing equipment, mark me cables to prevent accidental recuit.

cr-boat antennas should be taken any joints greased, and any eft in the deck or bulkheads . Leaving an antenna up inamage. Yard workmen have hown to break the antenna off nio squeeze a boat through a low by, or to tear it out by the roots an obstruction.

noment any equipment is taken shop increase your insurance to pecause, although most boats marine insurance covering all te, you need protection in case for contingent liability by the underwriter. The cost can be ed among the boats so served. out tag, with a number, and a or a description of the work to ne, and a parts and time record be put on the panel of each inint, and the same number d on every piece, such as the ot, cabinet, and remote control. a set should be put on the bench decked for operation, a prelimilest to find out early if the set me serious fault which might parts from the factory to cor-Early in the winter is the time e care of these troubles-not sboats start slipping down the in the spring. Do not bother ny alignment or other adjustof the "final" type. Too much ppen between now and commisr time.

ir this check the chassis can be out, brushed and vacuumed, a of silicone put on switch conand any corrosion removed. Kerapplied with a toothbrush, has round to be about as effective as

'ng for this job. inets that are not too badly corcan be spotted, after bad spots noothed and the old paint "feathwith sandpaper. A dull touch-up er is best, or it may be possible

acturer that will blend. Chromed can be sent out for re-chroming. handset cords should be re-, and operation tested, as they

an air-drying mix from the set

e rough treatment.

v is also the time to take care of ments, such as having engraved many owners want put on their one panels giving the boat name call letters, or modifying the ment for external speakers, the g of "bull horns" on deck, or ding for remote controls. The es are that some of these things be thought of by the owner the time he takes the boat out—it is

COMMAND CLOSED

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Bullt like meter needle moves into PM magnet with grins it to close contact rated 1 amp. Highly damped, vibration proof. Works directly from photocells, thermocouples, etc., without amplification. A momentary application of 12 to 30 v, AC or DC, resets it. 4 869.50 device for only. \$12.95

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June Radio & TV News describes tubeless crystal callbrator. Here is the Depot Spares xtal from Collins
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the spectrum, in transistor the spectrum in transistor the spectrum. In transistor the spectrum, Fr.245.A holders. NEW, tested \$2.95

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The TV barvain of the year! Factory rejected for minor
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better to think of them now when the work can conveniently and unhurriedly be done.

Well in advance of spring drag out all of the sets. Group them according to kind and use a check list for the operations. Check all tubes. Very few will be found low, but remember that marine radio is an emergency service, and the best place to catch incipient failures is on the shop bench. Another thing this will do is scrape corrosion off the tube pins and socket terminals. For this reason, also wiggle the crystals and the vibrator, even though it has a nice steady hum.

Align the receiver and check sensitivity with a signal generator. For sets not having crystal-controlled receiver oscillators use a "live" signal or an accurate frequency meter to line

up the front end.

Measure the transmitter frequency on each channel. The FCC regulations call for the official measurement to be made with the equipment on board the boat—but a preliminary check is justified because if a critical condenser has spilled its microfarads it can more easily be replaced in the shop than out in the bay.

Transmitter power-amplifier tuning should be checked with no load. A milliammeter or voltmeter jack is provided, and, if necessary, the final tank should be readjusted for minimum plate current. The transmitter coils should be carefully inspected for short-circuited turns, and any clips close enough to touch should be wrapped with plastic insulating tape. Clips should be tightened, as required.

Last, a dummy antenna should be connected, and the power output and modulation tested. Power is measured using a variable condenser and noninductive 34-ohm load, and an r.f. ammeter in series from the transmitter antenna post to ground.

Modulation may be measured with instruments built specifically for the purpose, or an oscilloscope. If these are not on hand observe antenna-current rise under full modulation. If there is no carrier shift a 22% increase is indicative of 100% modulation, while a 10% increase indicates about 65% modulation. The signal should also be monitored on a receiver to detect any hum, distortion, or other objectionable characteristics. During modulation measurements, amplifierplate current should be watched to make sure it does not fluctuate more than a few per-cent, which would be indicative of excitation shortage, parasitics, or overcoupling.

In the spring, re-installation will simply amount to putting the gear aboard, connecting up, and final check.

Work to be done should be strictly understood with the owner, and bills should be itemized in full. This became apparent to me after one nearlypainful experience.

The owner had said, very off-handedly, that when his radiotelephone was stored all of the garish (to him) brass on the panel should be removed,





Solve poor TV reception with a Hi-Gain B Banish weak fringe areas, reduce snow. The Comes to you as a highly serviceable Hill Tuner. Uses 6.16 Tubes in very efficient Circuit. Has 8 tuned circuits using pure inductances and individual compensation in high sign pain on all channels. Built I Vernier Drive.

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and chrome-plated, so the telewould better match the decor of in. This sort of request is comb the girl in my office jotted he order without comment.

telephone happened to have ole works fastened to the panel etting the brass separated returning the set into a fright-octopus of sockets, cables, and ig parts—strictly a basket case. The thing was finally put back er, resplendent in its new e front, the boatman was prethe bill: \$93. He sailed off on se and didn't show up the rest summer.

n he returned we had the bill down so it was apparent that taken so many hours to pull the art, so much was charged by ater, and then it took so many hours to put the parts back to-Although the total still came he could now understand why, a paid without a whimper.

t now to get some of this winork lined up. Hardly a boatman l need reminding that if they keep you alive during the offyou'll be around, better than when they need you next spring. TOR'S NOTE: All transmitter adents as described in this article be made by the holder of a comal radiotelephone second-class igher) operator's license. Any e shop contemplating entering arine servicing field should see comeone in the organization has ces out this license. The examicontains no code elements and hin the technical capabilities of petent service technician. -30-

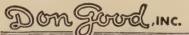
"Subscriber-Vision" (Continued from page 59)

ular week. The proper button s the correct combination to be for the particular program. The et sweep signals are then fed to orizontal output stage and apto the horizontal deflection coil. sound signal goes through the i.f. stages and is then detected normal manner. However, the t of the detector will be a scramamplitude-modulated signal. In to clear it up, the process at ansmitter is reversed. The signal into a frequency remodulator might actually be considered as nd detector. Also going into this ency remodulator is a signal the "Decoder" unit. With the et decoding signal, the unscram-sound is then fed to the audio fier and then to the speaker.

should be emphasized that this n, like other subscription plans atly being introduced, is still to proved by the Federal Communist Commission before anything than test transmissions are perd. When such action will be is anyone's guess.



NEW FULL-WEB "SHEATH-LEED"—the pure polyethylene of "SHEATH-LEED" and full characteristics of GOODLINE AIRLEAD—but NO PERFORATED WEB. No 20 (7 strand 28) copperweld wire in pure electronic golden clear polyethylene—with a pure silver-gray polyethylene sheath overall—for Maximum Weather Protection.



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1L4	.57	6AU6	.43	6L6GA	.80	12BE6	.47
1N5GT	.57	6AV6	.38	654	.46	12BH7	.63
1R5	.56	6B4G	.96	6SA7GT	.52	12BZ7	.7
155	.47	6BA6	.45	6SJ7GT	.47	12SA7GT	.52
114	.56	6BC5	.53	6SK7GT	.50	12SK7GT	.50
1T5GT	.71	6BD5GT	.89	6SL7GT	.62	12SL7GT	.61
1X2	.67	6BE6	.47	65N7GT	.54	12SN7GT	.54
3Q5GT	.65	6BF5	.60	6SQ7GT	.42	12SQ7GT	.44
354	.55	6BG6	1.34	6T8	.78	19BG6	1.39
3V4	.56	6BH6	.57	6U8	.85	19C8	.94
5U4G	.43	6BJ6	.48	6V6GT	.46	19T8	.79
5V4G	.73	6BK7	1.10	6W4GT	.45	25BQ6	,89
5Y3G	.34	6BL7	.83	6W6GT	.57	25L6GT	.41
5Y3GT	.30	6BQ6	.89	6X4	.34	25Z6GT	.4:
6AB4	.46	6BQ7	1.10	6X5GT	.33	35A5	.41
6AF4	1.40	6BZ7	1.10	6Y6G	.59	35B5	.47
6AG5	.54	6C4	.34	7N7	.52	35C5	.47
6AK5	.95	6CB6	.53	12AT6	.38	35L6GT	.47
6AK6	.63	6CD6		12AT7	.68	35W4	.3
6AL5	.40		1.85	12AU6	.43	35Z5GT	.3
6AN4	1.30	6F6GT	.45	12AU7	.55	50B5	.4
6AQ5	.46	6H6GT	.49	12AV6	.38	50C5	.4
6AQ6	.42	6J5GT	.40	12AV7	.80	50L6	.4
6ARS	.38	6J6	.62	12AX7	.61	117Z3	.3
	Motorola Ba	llast Tube	#17A485459	30		117Z6	.6

BROOKLYN 10.

Mac's Service Shop

(Continued from page 86)

moved the defective unit and replaced it with a new transformer, but wher he turned on the receiver it gave out with very poor quality and produced an audio howl at certain settings a the volume control. No checking @ filter or audio bypass condenser. turned up anything wrong, nor coult any of the normal causes of audio am plifier instability be discovered.

"I should have stood in bed," Bay ney said with a sigh. "And this way the day I thought was going to be a easy one! I can't pick a set that hall one nice simple little thing wrom with it like an open transformer. O no! I've got to draw one with comply cations."

"Maybe it didn't have complication until you replaced the transformers Mac suggested.

"What do you mean by that crack % Barney demanded truculently. "And you insinuating I can't even replace an output transformer without male ing a mistake?"

"Could be," Mac said with a shrur as he picked up the speaker with the new transformer mounted on i frame. "What's this wire going from one side of the voice coil to the speal: er plug?"

"I didn't trace it out, but I guesses it went to a terminal on the chassfor connecting an output meter acrost the voice coil," Barney replied. "Lot of sets use that, you know."

"But does this one?" Mac insiste as he pointed at the service manua shelf.

Reluctantly Barney hauled down service manual and studied the diggram. "It doesn't go to a terminal he said slowly. "Instead it seems a go back to the input of the first audi tube."

While the boy had been looking the diagram, Mac had picked up ti solder gun and had reversed the least coming from the output transforms secondary, leaving all the rest of the connections intact.

Then he turned on the set, and tl tone quality was excellent. No sigof amplifier instability could be foun at any setting of the volume control

"Since when has a guy got to α serve polarity in output transforms secondary leads?" Barney demanded "If that's necessary, why don't the color-code them?"

"Ninety-nine times out of a hundr it's not necessary," Mac explainer but this is the hundredth time. The set uses negative feedback, and t feedback tap is taken from one si of the voice coil. There is, of cours a 180 degree phase shift from o end of the voice coil to the other When you replaced the transformed you happened to solder the tap to t wrong side of the voice coil and started feeding back voltage that w "positive" rather than "negative

f course, accounted for the ality and the tendency to oscil-When the leads from the transwere reversed, all was well. and just looked at the diagram beginning to make sure of the of that lead from the voice u could have figured all this yourself."

sure a prize dope," Barney ad-"As many times as you have , it looks like I would learn to manuals. I've always been at, though. When I'm looksomething in a catalogue, I se the index as a last resort, ough I know I can find what I uch quicker by using it. I kind like I've been licked if I have the index.

the same way with the manuguess I'm trying to prove how I am by showing that I can get without them. What I end up g, as I've just shown, is how

am."
't be too hard on yourself," Mac d. "A mistake that's recognized corrected, and I'll make a l-thumber out of you yet—I -30-

Brightness Control Continued from page 81)

grid produce corresponding es, amplified and shifted in at the plate and on the pic-ube cathode. The brightness is adjusted so that, during the ng pulses, the picture tube e is sufficiently positive with t to the grid and the first anode nk out the screen. If the signal ude decreases by half, the picube cathode might become 20 ess positive during the blanklses, but only about 3 volts less e during the brightest parts of cture. The retrace lines would ble, but the white level would changed much., Video amplirect coupling is not, by itself, nole answer to the problem of atic brightness control. It does alf the job, keeping the white approximately constant; the half, keeping the black level

o amplifier direct coupling does wo advantages over the other ds mentioned. Its white level tion is instantaneous, since it ot depend upon condenser chargdischarging, while its black regulation is as rapid as the res a.g.c. system. If the maxiorightness changes from scene to the change is reproduced, as, with direct white clamping, scene has the same maximum ness. Many manufacturers, such niral, Arvin, Bendix, Fada, Gen-Electric, Hoffman, RCA Victor, m, Sylvania, and Westinghouse, used or are using direct-coupled amplifiers.

nt, requires a.g.c. in the re-

INEXPENSIVE ENCLOSURE

By J. WESLEY SWAUGER

WHEN I saw the specifications for the E-W speaker enclosure in the July, 1953 issue of RADIO & TELEVISION NEWS, I became enthusiastic about building one. Since the budget wouldn't stand the cost of the prescribed materials, I decided to attempt to construct it with ordinary corrugated pasteboard.

I first made a box of the right size and then proceeded to build it up by gluing on layer after layer of pasteboard. staggered the overlaps for added strength and applied new layers until it was five layers thick. Then I glued in the baffle plates and the partition.

My enclosure actually consists of two boxes: the one which contains the baffles and has no front slides inside the one on which the speaker is mounted and which has no back. This was necessary to provide a means of speaker installation.

The results are most gratifying. Although a plywood model would undoubtedly be superior, my eight-inch speaker gives better low-frequency response in this enclosure than it has ever given in any other baffle. It took a long time to complete the project because I had to let the glue on each piece dry for twelve hours, but the total cash outlay (for glue) was only seventy-five cents!

If you want an inexpensive enclosure that is fun to build and easy on the pocketbook, this is it.

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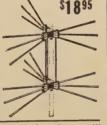
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1R5	1.05	6BL7GT	1.60	12BE6	.95
1X2A	1.25	6806GT	1.68	12BH7	1.25
3Q5GT	1.25	6C4	.85	12BY7	1.33
5U4G	.80	6CD6G	2.40	12SA7	.90
5V4G		6F6GT	.93	125K7	1.13
5Y3GT	.68	6J6	1,25	125N7GT .	
6AB4	.90	6K6GT	.83	125Q7	.98
6AG5	1.10	6L6G	1.60	25W4GT	.83
6AK5	2.18	6SN7GTA .	1.10	25Z6GT	.65
6AL5	.88	6V6GT	1.00	35Z5GT	.65
GAUSGT	1.35		.90	50B5	.98
6AU6	.90	ewegt	1.10	501 6GT	.88
GAVSGT	1.45	6×5GT		117Z3	.80
6BC5	1.00	7N7	1.10	11/23	.00

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NEW APPROACH TO TV SERVICE

By CARROLL W. HOSHOUR

Director of Sales Engineering
TV & Radio Div., Raytheon Manufacturing Company

A consumer guide and factory manual allow the servive technician to do half the job before leaving the shops

THE American TV-owning public has come to realize that no matter how well designed, engineered, and manufactured a TV set may be, sometime during the first year or two it will require service. This service may involve anything from component parts or tube replacement to something as relatively minor as a back apron control adjustment.

Any plan that makes such servicing faster and better is of benefit not only to the TV set owner, but to the service technician and the TV manufacturer as well. Among TV manufacturers there are those who believe that to admit that their sets will require service is "negative selling" and will cut down on their sales. The Raytheon Manufacturing Company, on the other hand, believing that a planned program or device that would assist both the consumer and the service technician toward a fast, efficient, and economical solution to their service problems would be of benefit to all concerned, has introduced the "Service Saver" to the TV industry.

The term "Service Saver" is used for the program since its prime function is to save time, save nuisance service calls, and, in turn, save money.

"Service Saver" Primarily, the makes possible the transfer of factual information from the customer to the service technician. Today, when Mrs. Jones calls for TV service and complains of black wavy lines in her picture, the service technician has to take a wild guess as to whether it is r.f. interference, sound bars, poor horizontal hold, or a.f.c. trouble. It is quite obvious that if he could see the condition that Mrs. Jones is attempting to explain, he could, in the great majority of cases, come completely equipped with proper tubes or components that would effect a speedy rem-

Raytheon has shown in their "How to Interpret What You See" lectures to service technicians across the nation (see Radio & Television News, April, May, and June, 1952) that approximately 90 to 95 per-cent of the troubles which occur in TV receivers appear as visible defects on the face of the picture tube. The service technician who has learned to interpret

from the face of the picture tuber the various circuits of a TV reconstribute in the average pictures in turn, recognize what circuit false responsible when a bad picture produced.

Some service dealers use applices or trainees on preliminary saving the more skilled technicial bench work or special calls. With accurate description of the training the customer, the skilled technical can explain to the apprential actly what tubes, adjustments, or cuits should be checked.

The "Service Saver" consists a units. One, a TV owner's guide companies each new Raytheon T ceiver. This booklet contains 40tures of different defects shown or face of a TV picture tube and c approximately 95 per-cent of their bles that can be caused by misas ment, tube, or component failure. picture is numbered and corresa to a specific defect. Arrows a word of explanation are used tot cate movement of the picture # terference effect. These pictures produced by a flying spot scanner ing a black shaded map of the L States feeding into a TV chass: addition to the pictures, lettere used to denote five different conditions that further assist the nician. Thus, for example, "A" dec normal sound, "B" no sound, ana hum or buzz in sound.

The second unit is the factory ice manual which is available service technicians. This manual tains a section in which the numpictures in the owner's guide a produced. However, here, each bered condition is described in with a sectional schematic country the particular circuit responsite parts list, a layout drawing chassis showing the position oparts in question, and a sugaprocedure for remedying the constitution.

Upon original installation of the ceiver, the customer is told the trouble should occur, she constant the should compare the picture of face of the CRT with the 40 ping in the guide. She then report number corresponding to her pland the letter corresponding to

to the service technician (or aking the call at the service). The service technician then uses his service manual to corthe picture with the defect.

a test of a group of average vives who were asked to identify ferent conditions on a TV reusing the "Service Saver," over -cent of the answers were cor-

h the "Service Saver" consumer and the service manual are availb all TV service technicians from ytheon Receiving Tube Division.

F. SUPPLY FOR SCOPES

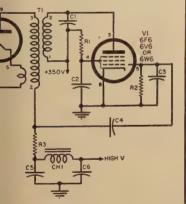
By HOWARD ZIMMERMAN

ONVERTED one of our scopes to power supply some time ago, and to considerable difficulty adapting be transformers to this application. ied several different makes and of coils before finding one which give us the desired results without se of extensive modifications or ircuitry.

circuit shown here is the one we settled on. Standard parts are hroughout, and the bleeder circuit scope does not have to be changed ther value resistors due to the repower developed by the oscillator. wo terminals of the transformer, "#2," were tied together on the al unit and must be separated to a negative voltage supply.

voltage output of the circuit can ried over a considerable range by on of different oscillator tubes. tubes with the voltages we obfrom them are given in the parts The amount of output, therefore, endent upon the tube selected, e.g., 6F6 the output is 1750 volts, with it is 2100, and with a 6W6 the t voltage becomes 2700 volts.-30-

e power supply circuit for a scope.



0,000 ohm, 1 w. res. 00,000 ohm, 1/2 w. res. 00,000 ohm, 1 w. res. 003 µfd. mica cond. 05 µfd., 600 v. cond. -50 μμfd., 1000 v. cond. -.002 µfd., 2500 v. cond. (use 5000 v. h 6W6)

i 6 w 6) i.5 kv. r.f. high voltage trans. (Stanwyck de 960)

ne you) -10 mhy, choke F6, 6V6, or 6W6 tube (High-voltage put 1750, 2100, and 2700 volts respec-ly) V2 tube



ments by manufacturer's model and

chassis number and also by original part number. Up-to-date . . . over 5600 models and chassis are covered, including virtually all sets built prior to 1953 as well as most 1953 models.

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A-8137	Hoffman #5035	29
A-8220	Philco #32-8555	24
A-8221	Philco #32-8565	18
A-8222	Philco #32-8533 & #32-8534	38
A-8223	Philco #32-8572	15



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Civil Mechanical

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Triad doesn't expect a serviceman to reconstruct or re-engineer a television chassis to accommodate a replacement part.

For that reason every Triad television component is circuit tested. As an example, Triad's R-BS Series Power Transformers, listed below, are tube socket types for use where rectifier tube is mounted directly on the transformer. They are made for under-chassis or top-chassis mounting and are exact replacements for many popular chassis.

	Plate Sup	ply	Filaments—Volts and Ampe		
Type No.	AC Volts	DC Ma.	· Filaments-	-voits and Amperes	
R-47BS*	725 V.C.T.	225	5V.—3A.	6.3V.—10A. 6.3V.—2.7A.	
Tube socket t	ype, wired for 5U4 condenser, low			360 V. into 80 m.f.d.	
R-48BS °	750 V.C.T.	180	5V.—3A.	6.3V.—9A. 6.3V.—2.7A.	
Tube socket t	ype, wired for 5U4 condenser, low			375 V. into 80 m.f.d.	
R-49BS "	650 V.C.T.	240	5V.—3A.	6 3V 9A 6.3V9A. 6.3V 1.2A.	
Tube socket t	ype, wired for 5U4 condenser, low			325 V. into 80 m.f.d.	

*B means Horizontal Mount; S, Socket Type

Triad Television Components will simplify and speed your service work. See your jobber for Triad Television Components, catalogs and replacements guides, or

Write for Catalogs TR-53A and TV-53A



4055 Redwood Ave., Venice, Calif.

Intermittent Checker (Continued from page 56)

the output stage. The other lines were placed at the screen of the output stage and at the cathode of the damper. After a period of about 50 minutes, the buzzer sounded and lamp #2 (monitoring the screen circuit) lighted. This indicated that the trouble was in the screen of the horizontal output stage. The trouble could not be in any of the previous stages, otherwise the grid lamp would have gone on. Checking the components in the screen circuit, it was noted that a 6800-ohm resistor had a resistance of 10,000 ohms. This resistor was checked about five minutes after the set was allowed to cool and, consequently, it may be assumed that it had an even higher resistance when the transient Replacing the resistor, occurred. which apparently was increasing in value as the temperature increased, remedied the trouble.

In another set, the video and audio disappeared and re-appeared intermittently but the raster remained. The trouble was therefore in common circuits; i.e., r.f., i.f., or video. set used a Capehart CX-37 chase The three lines were connected follows: #1 at the output of the view detector; #2 on the "B+" to tuner, since previous experience w this set indicated that the bleeder sistor frequently opened; and #3: the output of the video amplification After about 15 minutes, the buza sounded and lamp #1 lighted. T indicated that the trouble was eit in the video i.f. amplifiers or video With #1 left at the sas point, #2 was placed at the 3rd vin i.f. plate, and #3 at the 2nd video: amplifier. After about 20 minutes, buzzer sounded and lamp #3 lightl indicating trouble in either the 2nd 1st i.f. Examining the plate circuit the 2nd i.f., however, showed that connection to the i.f. transformer w corroded. The connection was moved and resoldered, and the trit ble was remedied.

These two examples should serve illustrate the wide field of application in TV service work of the intermitted recorder. No longer need intermittents be the bugaboo of the serve shop. This instrument should help reduce callbacks appreciably.

TRANSISTOR "WIRELESS MIKE" By A. H. HELLMERS

AN ENTERTAINING gadget of durable popularity is the "wireless mike," a voice-modulated r.f. oscillator which can be picked up in a standard broadcast receiver at distances up to 20 or 30 feet. In common with "wireless" phonograph oscillators and the radio remote-tuning devices sold some years back, these units are not transmitters in the FCC sense of the term as long as their range is small compared to the wavelength at the operating frequency.

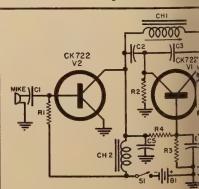
The transistor circuit shown operates in the low-frequency half of the broadcast band, where the wavelength is upwards of 900 feet. V₁ is the r.f. oscillator. The Colpitts-type circuit is tuned by means of a powdered-iron slug to an empty spot in the broadcast band, somewhere in the vicinity of 700 kc. This oscillator is "plate" modulated in the regular Heising style by a second transistor V₂. The microphone was a balanced-armature magnetic unit having a d.c. resistance of 200 ohms, obtained from a surplus collection. Since the input impedance of V₂ is on the order of 1000 ohms, a low-impedance mike is required. Crystal microphones will not work.

It was found that the tank capacitances in the r.f. oscillator circuit shown must be small, or the circuit will not oscillate at frequencies as high as the lower edge of the broadcast band. Hence an inductance somewhat larger than the usual broadcast coil (0.3 millihenry) is needed. The one used here is a commercial surplus item. However, it should be effective to rewind a broadcast-band coil to about twice the original number of turns. Experimentation is easy because no tap is required, and the "Q" need not be particularly high. In the present state of the transistor art there is, of course, no assurance that all individual transistors of any particular type will have the same upper frequency limit of oscillation. Broadcast band frequencies are definitely at the high limit, for

junction transistors, apparently, and that can be said is that two transist worked in this circuit.

The battery drain for the oscillal should be between 0.4 milliampere at 1 milliampere. Before operating the cuit, this must be checked. Proper It will vary with different transistors. It is adjusted by selecting the value of sistor R₁. The lower it is, the higher collector current. Bias for the modula transistor V₂ is determined by resistor which should be selected to give a clector current of 0.8 to 1.5 milliamper -30-

"Wireless mike" using CK722 transistore



 R_2 , R_3 —10,000 ohm, V_2 w. res. R_4 —22,000 ohm, V_2 w. res. (see text) C_1 —5 μ fd., 100 v. cond. C_2 , C_3 —27 μ μ fd., mica cond. C_4 —.01 μ fd., 100 v. cond. C_5 —.005 μ fd., 100 v. cond. C_1 —10 V0. V1. V1. V2. V3. V4. V4. V4. V5. V6. V7. V7. V8. V8. V9. V9.

-51,000 ohm, $\frac{1}{2}$ w. res. (see text)

ered telephone unit (see text) V_1 , V_2 —CK722 junction-type "p-n-p" transtor (Raytheon)

tified Record Revue

ontinued from page 70)

bass, it is more than offset sheer beauty of this great Vith NARTB equalization, a post in bass and treble was y. Surfaces were quiet. Cerot a hi-fi demonstration reca very thrilling piece of ell worth your time.

OS

VE SPANISH DANCES

haniz, pianist. Westminster $33\frac{1}{3}$ rpm, NARTB curve. 95.

dos was a master of his nstrument, the piano. In his that fact is very clearly re-These twelve pieces are not spanish folk tunes embroidered bellished by a master craftshese are the very essence of musical idiom, a penetrating y personal utterance of a man ew and loved his country. Mr. z has a big, solid tone and the l proficiency to cope with the ities of the score. Rhythm is ntial basis of this music and the right at home with the colorrations which give this music cally Spanish character. The cording is sharp, close to, genood. There is occasional thintone and some noticeable flutthese are minor faults. Reprowas satisfactory with NARTB tion and bass and treble set flat. Surfaces were a lity in my copy. Really enjoyable eces, but I would advise against of all twelve of them at one hey can get a little repetitious. eresting note is the way in Franados died. Most composers y don't meet their end in this he went down with the Engamship "Essex," when it was ed by a German sub in 1916!

NBERG

RVIVOR FROM WARSAW, SEC-CHAMBER SYMPHONY, and NIDRE

Symphony Orchestra and Acachamber Chorus conducted by warowsky and Herbert Hafner. a ML 4664, 331/3 rpm, Colume. Price \$5.45.

interesting works by Schoenigh priest" of the twelve-tone of music. "Survivor from Waror speaker, male chorus, and a, is a cantata about a death of some victims of the Nazis. d by one who escaped the the work is somewhat obvious opagandizing, but nevertheless verfully written and grim litof horror. The "Second Chamnphony" is for Schoenberg, a rical piece and not charactermuch of his atonal devices ects. Recording is good if uneven in the three works and surfaces were quiet. The LP curve reproduces it quite nicely without any touch up. An off-beat item you might like.

BRITTEN

VARIATIONS ON A THEME BY **BRIDGES**

WARLOCK

CAPRIOL SUITE

Boyd Neel String Orchestra conducted by Boyd Neel. London ffrr LL801, 331/3 rpm, NARTB curve. Price \$5.95.

Here is some more of the special Coronation releases of music by British composers. The Britten piece is by far the better of the two. The "Capriol Suite" is well recorded, but the performance leaves something to be desired. The "Frank Bridges Variations" is a vigorous work, though somewhat rough-hewn. The string tone has none of the "steeliness" some people complain about from London. Rather, the strings are rich and clean, with just enough edge to give them presence. Oddly enough, instead of the usual roll-off necessary in the bass end of London records, with equalization set at NARTB this one needed a little This kind of music is Boyd Neel's particular dish and he makes the most of it. Except for occasional raggedness, the string playing is outstanding and Mr. Neel elicits some wonderful sound from his well disciplined group.



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BARTOK

SONATA FOR TWO PIANOS AND PERCUSSION

SYMPHONY NO. 3

Leopold Stokowski and his orchestra. Gerson Yessin and Raymond Viola, pianists; Elayne Jones and Alfred Howard, percussion. RCA Victor LM1727, 33 1/3 rpm. RCA Orthophonic curve. Price \$5.72.

Well, I wish I could report to you that we have a real bang-up new version of the Bartok, but such is not the case. Oh, all the elements needed to make this a success are there all right. Mr. Stokowski is an absolute genius when it comes to conducting the moderns, the pianists are highly proficient with a keen insight of the complex score, the percussionists precise and alert. What's wrong? The sound dear friends, the sound. This should have been a hi-fi tour de force. Goodness knows there is enough material in the Bartok! What with snares and pedaled tympani and side drum, tam tam, cymbals, the gran cassa, bells, triangle, etc. you ought to be able to tear the house down. Unfortunately, whatever Victor did with the top end of this disc, it just doesn't come off. This is doubly unfortunate, because actually this is one of *Victor's* better efforts. The pianos are properly percussive in tone, the percussion bright and clean. It is just that very top end, that little extra that adds the punch and the presence to a recording that you miss so much. I dunno, maybe I'm hearing too much of this stuff lately, and I am splitting hairs and being hypercritical. Maybe you'll think it's great. It is just lacking that little something that sends me. The Roger Goeb work has some marvelous writing in it, although its not the kind of thing you fall in love with on the first hearing. Again Mr. Stokowski is at home with the music and favors it with a powerful reading. The Orthophonic curve needed correction for bass deficiency. As with most of Victor's records the surfaces were very quiet. In fact I think this quietness has something to do with the top end trouble. I'm going to investigate and I'll let you know what I find out.

VARIATIONS ON SEI GEGRUSSET, JESU GUTIG, and FIVE CHORAL PRELUDES

Finn Videro, organist. Haydn Society HSL3063, 331/3 rpm, AES curve. Price \$5.95.

Finn Videro is one of the world's great organ virtuosos. His playing of these beautiful Bach pieces is a model of good taste and his registration admirably chosen. It is too bad this is such a poor recording. The work played on a magnificent old baroque organ, suffers from tape flutter, and in the inner diameters the intermodulation distortion gets pretty fierce. This is not the kind of organ recording to test out the low frequency response of your speaker system. Its a

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HOVEN **ATA NO. 29**

Philharmonic Orchestra conduct-Felix Weingartner. Columbia 5, 33½ rpm, NARTB curve.

is the famous orchestral tranon Weingartner made from the al piano many years ago. Colums done an admirable transfer om the 78's and the recording nas benefited. Certainly not up ay's standards, it is nonetheless citing work and a good soundsc. Good orchestral balance with ent string tone and comparativeet in spite of its 78 origin. As to er this great work is more effecthe original piano version or canscription is a moot point. I hem both, and since it is exly difficult to come by a really performance in the piano origihis is a welcome, if somewhat change. In transfer, the equal-n has become the standard B and reproduces well from curve with a few db of boost in pass and treble.

ERO KY-KORSAKOV PRICIO ESPAGNOL

t Symphony Orchestra conducted ul Paray. Mercury MG50020, rpm, AES curve. Price \$5.95.

s is the initial effort of the De-Symphony for the *Mercury* ppian Series." To say that they neir best foot forward is to put dly. The "Bolero" has finally of age in this recording. You ask, why another "Bolero" when are already umpteen in the LP gue? The question is valid until nalyze the existing recordings. there is no really modern reg, and the others of fairly revintage were not wholly satisy. Secondly, there has not been ally good performance of this since the old Koussevitsky readon Victor. Here in this disc, 'Bolero'' becomes a new and ng experience instead of the tired old warhorse. Paray is an ing fellow who knows his way d, especially with French rep-. His pace in the work is er too slow, nor does it become tic. With poise and restraint he the final, shattering climax. The is finally the way it should alsound, crisp, clean and compelinsistent. The brass has good and is well played, the woodragged at times, but good solo throughout. The dynamic range is disc is incredible. Try this: the work through to the climax hen quickly put your pickup to eginning. You won't believe it! 'Cappricio Espagnol" is a knock This will be the hi-fi crowd's

nt. Terrific brass, thundering

tympani, and bass drum. Sharp, incisive strings. Clashing cymbals and gongs! All the things that are dear to the hearts of audiophiles. Paray gives the colorful work a spirited performance. His dynamic shadings are marvelously detailed and his beat sure and strong. If you want a big kick, wait till you hear the snare roll at the start of the second section. Wow!

BRIGG FAIR, ON HEARING THE FIRST CUCKOO IN SPRING, and OTHER SELECTIONS

London Symphony Orchestra conducted by Anthony Collins. London ffrr, 331/3 rpm, London ffrr curve. Price \$5.95.

Still another of those special Coro-

nation releases. This is soft lovely music, typical of Delius' dreamy halfworld stuff. Innocuous pieces, yet they have a certain strength and character. Collins leads his orchestra in a competent well-paced reading. Beecham is supposed to have the inside track with Delius, but I don't see how he could excel this Collins reading very much. Altogether admirable. sound is good and clean, if unsensational. This is not for the blood and thunder boys, but rather is the quiet dreamy sort of thing that goes well in the summertime, with a glass of cold beer on the front porch. Try it for yourself. This stuff can grow on you in no time.

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TV Sweep Generators

(Continued from page 46)

izontal input terminal of the oscioscope. The saw-tooth deflection vage which is normally used in a scope is turned off and the 60-cy-sine-wave voltage from the general is used instead to sweep the behacross the screen.

Now, why is this done? This is deperated because the frequencies being obtained from the sweep generator are varyaback and forth across the band is sinusoidal manner. Only by combined a sinusoidally deflected scanning betwith a sinusoidal sweep frequency viation can we obtain a response per tern in which the frequency is even spaced. This may sound somework complicated but it boils down to the scan weap term in the sweep generator of put one way, then to obtain a proper shaped pattern, the beam deflection the scope should be similarly variable.

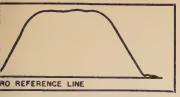
Suppose we don't do this. Suppose we forget to bring the extra 60-cy voltage from the sweep generators the scope. Then what? Then, instead of the single pattern shown in Fig. 3 we obtain the double pattern shown Fig. 6 with a 60-cycle sweep. It is possible to work with these two pattern fyou appreciate how they were placed. But, unless you have a coplete mastery of alignment techniquit is best to stick to the more normapproach.

Now, it is possible to deflect t beam in the scope sinusoidally wi out making the above-mentioned c nection between the sweep general and the scope. However, in such stances, the scope must have things: (1) a means of supplying own 60-cycle sine voltage to its h zontal deflection system and (2)! own phase control. Under these con tions, we adjust the scope's phase c trol to obtain a single pattern. We regard the sweep generator's phy control because its 60-cycle voltagi not being used. More and more osc loscopes are incorporating their o 60-cycle sine wave deflection voltate and the corresponding phase contr

Blanking voltages and controls: feature that is finding increasing in sweep generators is the blank circuit. This circuit, when turned injects a negative pulse into the swoscillator circuit in such a man that oscillation is stopped for half cycle. This has the effect of remove one of the two traces that is norm produced on the screen. Thus, electron beam in the oscilloses traces out the response curve of f

Fig. 6. Curves obtained when scope uses own saw-tooth sweep instead of 60-c sine-wave deflection voltage of general





A blanking circuit in a sweep or produces a zero reference line screen of the service oscilloscope.

under test on its first trip he screen. On the return trip, m would normally trace back e same curve. Actually this tracing is not necessary since des the same information as vious trace. Furthermore, there ally sufficient unbalance existthe circuit so that the second oes not coincide at all points e first trace, resulting in two at one or more points. Through of the blanking circuit in the generator, the sweep voltage ng the second trace is elimi-

n the scope, however, the not similarly blanked out and oduces a zero voltage or refere because during this period it ving nothing from the circuit est. See Fig. 7. (The circuit, same token, is not putting out ltage because it is receiving from the sweep generator.) esence of the base line aids the ian in evaluating the various of the response curve and tends to simplify and hasten vicing and alignment process. o base line proves to be espe-valuable for FM discriminator ent since in this instance the portion of the S-response curve extend for equal distances and below the zero base line. ost sweep generators containing

g, there is simply an "on-off" whereby the blanking voltage e brought into operation or off. In a few instruments, the of blanking voltage may be led, regulating the extent of ble pattern on the screen. Usumore blanking voltage than is ry should be employed.

entirely possible that the oscilmay possess its own blanking and generally, if one is emthe one on the other instrushould not be. In the oscillothe blanking control is usually bined "on-off" switch and po-neter. The switch brings the g voltage into the system while otentiometer determines its This control is necessary ben the oscilloscope the blanking usually applies a sine wave control grid of the cathode-ray This acts to intensify the trace the positive portion of the apine wave and to reduce the inor blank out the trace entirely the negative half cycle. With of the phasing control, the apne wave (that the control grid cathode-ray tube receives) can

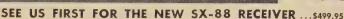
be shifted in phase until the undesired portion of the screen trace is blanked out. Without this phase control, it could happen that some or all of the desired portions of the response curve would be blanked out, leaving the undesired or unnecessary sections visible.

It should be noted that while the blanking controls in the sweep generator and in the oscilloscope perform essentially the same function, there is one difference between them as far as the visual pattern is concerned. That is, when the blanking circuit is turned on in the scope, one trace of a response pattern is eliminated but with no reference line produced instead. The reason, of course, stems from the fact that the blanking control voltage

here removes the second pattern by cutting off the CRT beam. When the blanking circuit in the sweep generator is used, the beam of the CRT is not cut off and so it is able to produce a base line.

Sweep phase reversal: On one or two sweep generators a sweep reversal switch has been incorporated. What it does is reverse the phase of the 60cycle sine voltage that is sweeping the frequency of the generator back and forth. The purpose in providing such a switch is to permit the response curve to be presented with the low frequency section of the curve appearing at the left-hand side of the screen and the high-frequency section at the right-hand side. See Fig. 8B.







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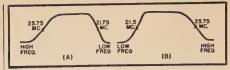


Fig. 8. A sweep phase reversal switch can reverse pattern obtained on screen. See text.

It can happen, because of the manner in which the test equipment is designed, that the response curve obtained on the screen will have the high-frequency section on the left and the low-frequency portion on the right. See Fig. 8A. There is, of course, nothing wrong with this pattern and it may be used during an alignment job. However, response curves are ordinarily shown in textbooks with the low-frequencies at the left and being able to switch a pattern from the form of Fig. 8A to that of Fig. 8B may be helpful to the technician. This is the purpose of the phase reversal switch or control.

It may sound repetitious to note that some scopes possess the same facility, here, too, with the purpose of assisting the technician. Whether or not the technician avails himself of this convenience, when it is present, is purely a matter of personal preference. Some men do not mind working with a reversed pattern; others find it helpful to set the curve up in its more traditional form.

It is interesting to note that if you have an oscilloscope which can supply its own 60-cycle sine-wave deflection voltage, you can reverse the phase of a response pattern *without* a special phase reversal switch. Here is how this is done. Set up the instruments for the alignment but have the scope provide its own 60-cycle sine-wave deflection voltage. Then observe the response pattern on the scope screen and if it is reversed, simply reverse the scope's power plug in the line socket. This will turn the pattern around to the desired form.

Sweep generators with internal variable markers: Sweep generators must always be used with two other instruments: an oscilloscope, of which we have already spoken, and an AM signal (or marker) generator. The scope is needed to present visually the shape of the response curve. Because of the dependence of the sweep generator on the marker generator, the two are often combined. In some instruments. the marker generator is definitely an auxiliary unit, serving simply to provide identification signals in the i.f. range. This, for example, is true of the Hickok Model 610A where the marker range is from 19 to 48 mc. In other instruments, the marker generator is a full-fledged partner, being similar to any of the separately contained r.f. television signal generators available on the market. In this category fall the Jackson, Simpson, Triplett, and Philco instruments. In each instance the AM generator can independently supply r.f. signals ranging from three or four megacycles up to 250 mc. (216 mc. in one instance). This enables these marker generate to develop signals that will cover of the FM and v.h.f. television i.f.i r.f. ranges.

The advantage of incorporatini marker and sweep generators in cabinet is, of course, greater each combining the marker voltage the sweep signal. With the in ments merged, we do away with connecting wires between them. bination of the two signals is complished automatically while strength of each signal can be pendently adjusted for best ret Of course, placing two generator one cabinet means that you pay both, although the increased co seldom as much as it would each generator were packaged vidually.

Some manufacturers prefer to: their marker generators sepe from the sweep generator, feeling this unit is an instrument in itst right. The separate packaging, enables the manufacturer to enthe scope of the marker generate applications, something which is i erally not feasible when this un combined with the sweep general Thus, RCA in its marker gener has such extra features as a h odyne frequency meter with amp and speaker, a bar-pattern gener for making linearity adjustments a dual-crystal standard with crystals supplied.

So the instrument you choose pends upon the extent of your and how much you feel the should be able to perform.

Sweep Generator Application

The successful application of test instrument is a twofold a First, the controls must be proset in accordance with the use which the instrument is to be. Second, the proper connections be made between the unit and test point. In the case of the separator, the second step is frequely the more difficult one. A man be perfectly able to tell you what control does and yet get weird terns on the scope screen (if, in the gets any at all) when the in ments are set up.

In view of this difficulty, let use ceed, step-by-step, through an a sweep alignment of the video i.f. tem of a television receiver. First receiver is set up on its side on bench so that the various i.f. are ments are accessible. Next, an alloscope is placed beside the received and a lead is run from the video and detector load resistor, through 10,000-ohm isolating resistor, to vertical input terminal of the oscope. Also, the ground post oscope is connected to the chasa the receiver. See Fig. 5.

the receiver. See Fig. 5.

(Here is the first point value to trouble can be encountered. Make tain the connection is made to load resistor of the video second tector. It is generally not advisal

the video amplifier system for onnection because in many sets, ponse to 60 cycles is only fair. the response curve has a 60epetition rate, a poor response frequency can seriously affect ape, i.e., the tilt of the curve.) sweep generator is brought in Connection is made from the tor output to the grid of the stage. In the widely-used Standil tuner, for example, there is ial terminal available to which onnection can be readily made. er tuners it may be necessary ke 'contact directly with the grid terminal on the tube sockthis point is difficult to reach, ernative method is to lift the on the mixer tube and connect eep generator signal lead to it. ing the shield sideways slightly be made to rest on the glass of be. If this is done carefully, the will be supported by the tube pe and hence prevented from ting the chassis and grounding gnal.

complete the generator conneco the set, a wire is run from ound terminal of the instrument receiver chassis.

next step is to bring some of enerator's sweeping voltage to orizontal input terminals of the scope. The thing to watch out re is the proper setting of the controls. Just making the interction between the two instruis not enough, for unless the is set up to receive this deflecoltage, the beam will continue driven by the saw-tooth voltage ped internally by the scope. So s another possible trouble point. ore the equipment is placed in tion, the receiver oscillator must sabled to keep it from feeding oltage to the mixer during the nent period. Without doubt, this aused more confusion than any single item.

are almost ready to go, but one preparatory step remains. The g of the bias on those stages are a.g.c. controlled. Most manuers recommend a value of —3 and this can be obtained from a ate bias supply or from a couple shlight batteries.

power is now turned on and quipment is permitted to warm et the sweep generator to the alue of the frequency range to vered; adjust the sweep width ol to a value of from 5 to 8 mc. a video i.f. system). Generator t is initially turned to its maxiposition. On the scope screen, sort of indication should be ob-I. Initially, this will most likely ouble pattern, of the type shown . 4B. Adjust the phase control a single pattern is obtained. If ing of the second trace is denow is the time to do it. Make he signal is not overloading the i.f. stages; this can be checked e following simple test. Rotate

the output control on the sweep generator. If the video system is not being driven too hard, the amplitude of the curve will vary in step with the rotation of the output control.

The final step in this alignment setup is the introduction of the marker signal. However, never take this step until the response curve itself has been obtained. In this way, swamping of the response curve (which can readily occur) will be immediately apparent. Also, by following the foregoing sequence, the number of different variable factors that you have to deal with at one time is reduced, thereby lessening the number of possible sources of trouble. A slow, methodical approach is always the fastest way to carry out a sweep alignment, especially when the equipment is not completely familiar to you.

The foregoing discussion, of necessity, was kept brief. However, the most important obstacles were pointed out and if the proper precautions are observed, no major difficulty should be encountered. Remember: Never do many things at one time; introduce each step in turn and you will seldom find yourself lost.

From the points outlined in this article it is easy to see why the television sweep generator is such a valuable adjunct to the test bench equipment for the technician. Its proper use can speed service jobs and result in a more profitable operation.

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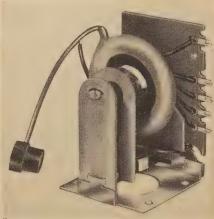
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NEW TV PRODUCTS on the Market on the Market

The Standard Division of Chicago Standard Transformer Corporation, Addison and Elston Avenues in Chicago, has released five new TV replacement components in the Stancor

The new components include an exact replacement flyback transformer,



A-8137, duplicate of the Hoffman #5035 used in 25 Hoffman models and chassis; and the A-8126, universal Philco replacement vertical blocking oscillator transformer. The A-8126 can be used in all *Philco* TV models and chassis built up to the spring of 1953.

Two width controls, WC-1 and WC-4, and a tapped linearity coil, WC-2, have also been added.

Bulletin #468 listing specifications and replacement information on these units is available from Stancor distributors or from the company direct.

NEW TV ANTENNAS

General Antenna Mfg. Co., 1652 Rockwell Ave., Cleveland 14, Ohio is now offering a new u.h.f. antenna which is said to be effective up to 50 miles, depending on local conditions. The 500-U is described as covering all u.h.f. stations, having low vertical radiation angle, low standing-wave ratio, and 300-ohm terminal impedance. The antenna is all aluminum and heavily constructed.

Television Hardware Mfg. Co., 919 Taylor Avenue, Rockford, Ill. is now introducing an indoor u.h.f. antenna which performs well when within range of the TV station or where an indoor antenna is practical for u.h.f. reception. This "UHF Butterfly" is designed to be placed on top of the set for use on any channel from 14 to 83.

Trio Manufacturing Company, Griggsville, Ill. has made a radical improvement in its line of "Zig-Zag" antennas which boosts performance on every channel. The improvement is accomplished by the use of a new re-

entrant network which provides as most perfect impedance match to line on every channel. Current ments of these antennas will ini the re-entrant network and a ph harness for use when stacking models for all-channel, single feed operation.

Wells & Winegard, Burlington, has introduced the Model CP-1 " per" to its line. The "Clipper," a a gain fringe area unit engineerer complete coverage of all v.h.f. (nels, offers high uniform gain, ohm match, one major forward lc narrow beam to reduce ghosts t noise pickup, and high signal-to-o ratio. Details are available from manufacturer.

PORTABLE TOWER

A new portable tower of alumn alloy is currently being marketet u.h.f. communications application Up-Right, Inc. of 1013 Pardee, B ley, California.

The tower is built by setting inco ual sections one on top of the c Of patented one-piece construct each folding section is assembled of out tools. Innovations in the gr systems eliminate the use of buckles, cable clips, and other hardware. The base may be rai leveled on a simple foundation.

Portable towers up to 300 fef height are available from the pany. Full details may be obtained request.

NEW G-E TUBE

The Tube Department of Ger Electric Company, Schenectada New York is offering a new, 242 aluminized glass rectangular vision picture tube which is she



than most 21-inch glass rectand tubes available today.

The Type 24CP4-A has a deflet angle of 90 degrees, a major fact making it shorter than standars es of the same type. It measy 21% inches over-all.

ube's aluminized screen is said ase light output and picture It also incorporates a highgray faceplate to improve pictail under high ambient light ns. The tube operates with c focus and deflection and intes an external conductive which is used as a filter conwhen grounded.

nmended operating conditions an anode voltage of 16,000 grid 2 voltage of 300 volts, a voltage of from -33 to -77focusing coil current of 119 d an ion trap intensity of 40

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elevision tubes having either l-wired or series-wired heaters. unit relieves cathode heater problems, its isolating type rmer giving normal 6.3 volts to ater to relieve the cathode roblems or 7.8 volts to increase e emission and restore lost ess. A simple switch allows seof the correct voltage.

trated literature on the "Uni-TV Tube Britener" is available iest.

TV BOOSTERS

burne Manufacturing Co., Inc. Radford Place, Yonkers, New now offering a new i.f. signal for u.h.f. and v.h.f., the Model

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- Oscillator radiation often causes disturbing interference with neighboring sets. In the Turner converter the oscillator tube socket and all associated circuits are inside the coaxial cavity, self-shielded. Removable covers provide a second shield against radiation.
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A completely new damper diode, 6AU4GT, designed for use with large screen 90 degree deflection picture tubes is in production at Tung-Sol Electric Inc., 95 Eighth Ave., Newark 4, N. J.

The wider deflection angles and the increased second anode voltage required to maintain picture brightness call for higher deflection power and increased circuit efficiency. The 175 ma. rating of the Tung-Sol-designed and developed 6AU4GT is more than adequate, with ample safety factor, for these new designs.

Complete technical data is available from the company on request.

PLASTIC SPRAY

Acrolite International, Dept. T-3, Hillside, New Jersey, has released a new plastic protective coating for radio and television service work.

This heavy-duty acrylic plastic is compounded to insulate, waterproof, and stop rust and tarnish. The coating is packaged in a spray bottle. A press of the button and the spray may be applied directly to the part to be treated.

Free literature on additional uses for this product will be sent by the company on request.

U.H.F. CONVERTER

A low-cost u.h.f. all-channel television converter, the "Star," is now being offered to the trade by Granco Products, Inc. of 36-17 20th Avenue, Long Island City 5, New York.

The unit incorporates coaxial tuned cavity elements to insure low noise, high gain, and good frequency stability. The converter is simple to install and requires no i.f. adjustments. A selector switch turns the TV set on and



off and provides instant changeover between u.h.f. and v.h.f.

The converter is housed in a mahogany plastic cabinet. It uses a 6AF4 oscillator tube, a 6CB6 i.f. amplifier

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Ideal for trouble-shooting television in the or on the bench. Used under actual operating ditions, will out-perform more expensive tes

A MUST FOR EVERY ALERT TV TECHNICAL SPECIFICATIONS: The "DYNATRACER" is a powered quality instrument designed to tracising a power of the power of t

ADDED FEATURE: The "DYNATRACER" will trace voltages and instantly locate open, sho or intermittent condensers, resistors, coils, sp ers, transformers, etc.
COMPLETE INSTRUCTION BOOK ENCLOSE

10-DAY MONEY BACK GUARANTEE Clip adv., write name and address in margin, a \$5.00 Bill, Check or M.O. and mail to

entity ELECTRONICS C 8509-21st Ave., Dept. 205, Brooklyn 14. N nd a crystal mixer. It is shipped o install and operate at 117-120 0 cycles a.c.

ALSCO U.H.F. CONVERTER

co Electronics Corporation, Los s 18, California is now in proton a new u.h.f. converter for the company claims outstand-formance.

new unit, which has been tradethe "Imperial," features an exnew turret-type bandspread ith a double-tuned preselector.



"Turretune" feature provides a LC ratio.

"Imperial" covers the entire frequency spectrum from 450 to ac. It has perfect tracking on than eight points for maximum and lowest noise figure. A "balline" oscillator keeps frequency to a minimum. Input antenna nals are provided for separate and v.h.f. antennas but can be with combination antennas.

COAX TUNED ELEMENTS

nco Products, Inc., 36-17 20th de, Long Island City, 5, New now has available two types of coaxial tuned elements.

Model UHO is an oscillator elewith a built-in 6AF4 tube. The UHR is a preselector element. models incorporate resonant cavming which features a moving er permitting coverage of the u.h.f. television band. All eleare completely wired and

CR TUBE ADAPTER

erex Electronic Corporation, 23 ton Street, Yonkers, N. Y., is ntly marketing a picture-tube er that can be used with any of tube tester and all picture

e end of the adapter plugs into ube tester and the other end into the picture tube without ring the tube from the cabinet. tube, electrostatic or magnetic 10" to 30", can be checked for de emission, shorts, etc.

PORTABLE ANTENNA

der Manufacturing Company of delphia 40, Pa., is currently marg a new portable television anfor u.h.f. and v.h.f. reception. denamed the "3D," the new ancovers all channels from 2 to 83

ffords maximum adjustments to

take advantage of weaker-than-normal indoor signals. With two 3-section, gold tone brass staffs, the antenna features the company's "Directronic" 6-position beam selector which uses a new criss-cross phasing element in a variety of circuit arrangements. This helps to provide proper impedance matching, orientation, and ghost elimination.

A catalogue describing this and other antennas in the company's line is available from the firm on request.

24-INCH PICTURE TUBE

National Union Radio Corporation, Hatboro, Pennsylvania is in production on a 24-inch rectangular picture tube, the Type 24C/VP4. The new tube is magnetically deflected and magnetically focused and employs a tinted gray faceplate. Minimum over-all length is achieved through the use of a 90 degree deflection angle. Picture size is approximately 17¼" x 21¾". The tube is rated for operation with second anode potentials up to 18 kv. Typical operation calls for 300 volts on G2 and 17 kilovolts on the second anode.

TVI ANALYZER

A TVI analyzer, which has been designed to identify interference signals to speed servicing, is now in production at *Tele-Matic Industries*, *Inc.*, 1 Joralemon Street, Brooklyn 1, New York.



WORLD'S LARGEST MANUFACTURER OF CUSTOM BUILT TELEVISION

SILVER ROCKET 630 CHASSIS with TUNEABLE

BUILT-IN BOOSTER for Better DX Reception

Featuring NEW CASCODE TUNER made for UHF interchangeable tuning strips and COSINE YOKE



All Channel J Booster

Broad band single knob control pre-amplifier built in to eliminate long leads which may cause regeneration and attenuation of signal.

• ONLY THE MATTISON 630 CHASSIS HAS AN ALL CHANNEL TUNEABLE BUILT-IN BOOSTER THAT INCREASES SIGNAL STRENGTH UP TO 10 TIMES.
THE SILVER ROCKET WILL OUT-PER-FORM ANY CHASSIS MADE AND IS PRICED RIGHT TO SELL FAST WITH

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AVAILABLE FOR IMMEDIATE DELIVERY! SILVER ROCKET FOR 27" OPERATION

ANNOUNCING the New AMBASSADOR for 1954

The only open face console made in every expensive decorator finish . . . on guaranteed genuine mahogany, walnut, oak and other

rare woods!



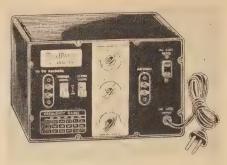
The AMBASSADOR 21" and 27" Best Looking . . . Best Value, Tool
Full size console for eye level television. Available in every expensive decorator finish. Featuring removable safety glass. ALL CABINETS MADE IN MATTISON'S OWN CABINET FACTORY.

DEALERSI SERVICE DEALERS! Here is your opportunity to become the "important" TV Dealer in your area for THE FINEST CUSTOM-BUILT LINE OF TV RECEIVERS. FREE!! Write for Mattison's merchandising portfolio explaining the "UNASSEMBLED PLAN" and "\$1,000,000 FLOOR PLAN."



Mattison Television & Radio Corp. 10 West 181st St., Dept.RN, N.Y.53, N.Y.

The analyzer contains a high-pass and ignition filter section, an a.c. line



filter section, and a full range of calibrated wave traps. The desired wave trap is selected by a rotary switch and tuning is accomplished with two calibrated selector knobs.

"NO-GAB" CONTROL

One answer to the complaint of over-long commercials is being offered by Franklin Sales Company, 2149 West Washington Boulevard, Los Angeles 54, California.

Known as "No-Gab," the device cuts off unwanted sound but lets the picture continue in a normal manner. The device may be attached to the set in 3 minutes. It can be operated from any point in the room.

Additional details on this unit will be supplied by the manufacturer on request.

TWO-SET COUPLER

Radio Merchandise Sales, Inc., 2016 Bronxdale Avenue, New York 60, N.Y. has added a two-set coupler to its line of antennas and accessories.

Known as the Model ZZ-2, this pigmy-size, low-cost coupler employs an iron-core network and transfers maximum signal from the antenna to both sets. Hardware for mounting the coupler is supplied with each package.



For additional information on this and other items in the company's antenna and hardware line, write the firm direct.

TELCO ARRESTER

Television Hardware Mfg. Co. of Rockford, Ill., a division of General Cement Mfg. Co., is now offering a new UL-approved lightning arrester for both indoor and outdoor use.

AUTUMN SAL PRICES SLASHER

T.V. TUBES-ROCK BOTTOM PRICE In lots of 6 each No. only .89c;6C86 ..39c;6AQ5 ..38c 6T8 .89c;6AK5 ..69c 6CP6 ..\$1.05 1L4 .47c 6BQ6 ..57c 6S4 ...49c 1T4

Heavy Duty Shielded P.P. Input Trans. H.D. Silver Contact Trans. Keys.... Isolantite Octal Panel Clamp Sockets.

100 Assorted Resistors.....

Mfd., 1,000V Oil Filled Cond. 2 Gang Var. Cond. 456 K.C. with Osc. Section 23/4 in. Pulley on 3/8" Shaft..... z94 m. Fulley on 35" Shaft.

Westinghouse Kuprox Rectifier 0.64 Amp. 2

Volts. Reg. \$11.00 ea. Special.

BRAND NEW 10" PHONO RECORDS—Ass't,

Jazz—Popular, Rhythm—Blues. Please specify
12 for \$1.79 or 24 for \$3.00 or 50 for \$1

Single Pole—10 Pos. 2 Gang Switch.

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Grind your own Crystals. Pure Brazilian Quartza

Guus sizes and thicknesses. 44 lb. pkg.

Signal Corps Phones—2 M. Ohms (8 M. Ohms)

Ph. Ext. Cord (and Plug)

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2 Ghoke Colls...

2 Choke Colls...

2 Choke Colls...

1/4 M.H. R.F. Choke Coll....

2 To und. App. AC Line Cord...

Miniature 7 & 9 pr. Sockets...

7 Ea. 66

RCA 4" x 6" Oval P. M. Speakers...

TUBULAR ELECTROLYTICS
20-20 MFD. 150 V...49c 30-30 MFD. 150 V.
40-40 MFD. 150 V...59c 80-50 MFD 150 V.

D. 150 V... 59c 80-50 MFD 130 V... 59c 80-50

14 PI.—56 Mmfd....28c SWITCH...
1,000 OHM WIRE WOUND POTENTIOMETER. 30 HY-FILTER CHOKE SHIELDED....3 for
PIEZO CRYSTAL HOLDERS...12 for \$1.00—56.06

PIEZO CRYSTAL HOLDERS, 12 for \$1.00—\$5.00
RCA Band Switches—
3 gang, 3 pos. 3 band.30c 6 gang. 4 pos. 4-6 ba
Trimmer-Padder Asst.—all isolantite—singles.
triples—100 asst.
ATTENTION: Prospectors, Explorers for HidenTre.
Construct a U.S. Army Type of Metallic Mine D
Amplifier. Amplifier unit only (less tubes an
teries) with cables, headphone cord, and jack.
wiring diagram. Type AN/PRS-1.

MINIMUM ORDER \$3.00—NO C.O.I SHIPMENTS—PLEASE INCLUDE POST NEWARK SURPLUS MATERIALS CO. 324 Plane Street, Dept. OC, NEWARK 1,



17" Table \$122⁶⁸ Pl. \$12.27 Fed. Excise Tax

20" Table \$134⁵⁰

PI. \$13.45 Fed. Excise Tax

Check these luxury features: Ultra sensitivity, dynamic range control, UHF adaptability, Duo power supply, Acousticlear Sound system . . . all in a beautiful Mahogany fin-

\$149 PI. \$15.00. Excise Ta 21" Con: \$164

PI. \$16.50

ish cabinet. ALSO AVAILABLE TV CHAS

All sets have full 1-yr. factory picture tube tranty, and standard 90-day RTMA parts warrs Mail and Phone Orders Filled. 825 deposit, baC.O.D., Shipping Charges Additional.

STEPHEN SALES CORP. 45 Crosby St., N.Y.12, N.Y. Phone: WO4-

Dealer Inquiries Invited

ew "Telco" unit has no lugs to nd no wires to strip. It will n a wall with two screws or and masts with a strap.

ogued as part No. 8642, the t comes complete with mountps and screws. It is available distributors or additional inbn may be obtained by writing pany at 919 Taylor Ave. in

H.F. SWEEP GENERATOR

London Instrument Co., P.O. , New London, Conn. has anthe availability of its Model f. sweep generator.

ring single-range tuning and a sweep width, the unit is defor either laboratory, producservice use.

o features at least one volt in 75 ohms, continuously varitenuator, a blanked signal on urn sweep to provide a referse line, no beating, no multipliand simplicity of operation. A t balun is available for conto 300-ohm load.

U.H.F. TRIMMER

Manufacturing Company, Inc., xteenth Ave., Brooklyn 4, N. Y. oduction on a "Mighty Midget" ype variable trimmer condendel VC3-G for u.h.f. television nufacture and replacement reents.

trimmer measures 1" over-all imum capacitance. The capacirange is 1 to 8 μμfd. The unimounting design fits any u.h.f.

ison Radio Amateur Award which given by General Electric Company ebruary to the amateur judged to performed the "outstanding public of 1953," is inspected by, left to eorge E. Sterling, FCC commissioner e of the award judges; G. A. Bradlvertising manager of the company's Department; and Goodwin L. Dos-IRRL president and another award Other judges are E. Roland Harriresident of the American Red Cross ardner Cowles, editor of "Lock."



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CHROME MUSIC BOX—Containing 5" Speaker and Coin Timer Motor. Can be used for remote speaker in Home, Car, Boat, Shop, Office, etc. Timer Motor operates from 24 Volt 60 cycle. Prices:

With 5" Dynamic Speaker \$3.95

With 5" PM Speaker \$4.95

TRANSFORMER—24 Volt—to operate Timer Motor from 110 Volt 60 cycle. \$1.50

BLOWERS-115 VAC 60 CYCLE



IC880 ...\$13.03
COMPACT TYPE: 108 CFM. Motor built inside squirrel cage,
4½" intake; 3¾" x 3" Dis. Complete size: 4¼" W x 8¾" H x 8½" D. Order No.
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FLANGE TYPE: 140 CFM. 3½" intake; 2½" Dis. Complete size: 7½" W x 7¼" H x 6¾" D. Order No. 1C807

AERIAL WIRE—Phosphorus Bronze #16 Stranded, 200 lb. test. Weatherproof, 150 Feet \$1.50 on Reel. RL-3 with Clips Telephone Wire-3 Cond. copper & \$4.75

BC-709 PORTABLE AMPLIFIER—One Tube \$4.95 uses 671/2 V. and 1.5 Volt Batt.—NEW....

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TRANS.—REC.—PORTABLE, READY TO OPERATE. BC-745 TRANS.-REC.: Crystal Controlled, covers Freq. 3 to 6 MC. by use of Plug-in Coil. With PE-157 Power Supply, BB-54 2 Volt Battery, Speaker, Antenna, Mic., and Crystal for 5030 KC. Set size: 57x57x67, mounted on Staff 30° Lg. Power Supply operates from 2 Volt Wet Battery rechargeable from 6 Volts and houses Speaker. Price: Used—\$49.95 Tested-Complete.

T-39 CHEST SET—Has Speaker & Space for \$4.95

BC-745 TRANS. & REC.—CHASSIS ONLY—No Cove Staff or Antenna, but w/Tubes— NEW. \$14.95
ANTENNA—Telescoping, for above set.\$2.00

RECEIVER AND TRANSMITTER

Special Buy-Both Rec. & Trans.: \$15.00

 TRANS. CONTROL BOX BC-232 w/Plug.
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 PLUG f/Rec. PL-61.
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 F/Trans. PL-64.
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SOUND POWERED HEAD AND CHEST SET

Navy Type—No Batteries Required—Ideal for TV Antenna Installations and many other uses. 20 Ft. Cord. Used—Tested: \$5.95 EA.



TELEPHONE WIRE FOR THE ABOVE

FIELD WIRE—2 Cond. Twisted, Weather proof, Heavy Duty, W-110—525 Ft. Roll. \$4.75 COPPER WELD WIRE— Weatherproofed, 2 Cond. Solid. 1200 Ft. Rell. \$10.00. Per Ft. @ .01c per Ft.

COAXIAL CABLES:

RG-34/U 71 ohms, 145 ft. \$15.00

DYNAMOTORS:

| INPUT: | OUTPUT: | STOCK No.: | PRICE: | 14 V.DC. | 330 V. 135 MA. | DM-330 | \$7.95 | 12 V.DC. | 250 V. 50 MA. | DM-25 | 8.95 | 12 or 24 V.DC. | 500 V. 50 MA. | USA/0515 | 4.95 |

PE-101C DYNAMOTOR

6 OR 12 VOLT (Reprints of original CQ conversion articles—Oct. and Dec., 1952 issues furnished.)

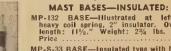
• This is the Dynamotor the Hams have been talking about! Easily adapted to supply 625 V. @ 150 MA. and 325 V. 125 MA. at 12 Volts—or 300 V. \$4.95

90 MA. and 160 V. 110 MA. at 6 Volts. NEW

BATTERY SWITCHING UNIT and

METERUsed to switch load from one battery to another—or 6 to 12 Volts. Contains 2" Meter

ANTENNA EQUIPMENT



MP-132 BASE—Hustrated at left—1" heavy coil spring, 2" insulator. Overall length: 11½." Weight: 2¾ lbs. Price \$3.95

MAST SECTIONS FOR ABOVE BASES

TRANSFORMERS 110 V. 60 Cycle Primaries

Address Dept. RN • Minimum Order \$5.00 • Prices F.O.B., Lima, O. • 25% Deposit on C.O.D. Orders

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WALKIE-RECORDALL 5 ib. miniature SATTERY Continuous, permanent, accurate, indexed recording at only 5c per hr. Instantaneous, permanent playback, Picks up sound up to 60 ft. Records conferences, lectures, dictation, 2-way phone & sales talks: while walking, riding of flying, Records in closed briefcass with "hidden mike"! Write for Detailed Literature

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CORONA RADIO KITS

• Easy Assembly

• Excellent Reception SINGLE BAND SUPER



Rocket 115K—Latest superhet circuit for ultimate in sensitive reception and tonal quality. Kit reception and tonal part of the reception and tonal quality. The reception and tonal quality and tonal quality. The reception and tonal quality and tonal quality. The reception and t

2 BAND AC-DC SUPER

Plaza 812K—Excellent sensitivity. Tunes standard Broadcast 535 to 1800 Kc. foreign shortwave 8 to 18 Mc (16.6 to 50 meters) foreign shortwave foreign shortw



easy step-by-step instructions included. Net \$20.75
3-BAND SUPER Globemaster 814K Complete Kit Net \$24.75 All kits supplied less wire and solder. Please in-clude 25% deposit with C.O.D. Orders. Dept. N-10

CORONA RADIO & TV CO.

listening quality

is

everything ...

(another music lover sees light)

"... I used to buy every new pick-up that came out, but no more. Your slogan, "LIS-TENING QUALITY IS EVERYTHING," has saved me quite a few dollars. I have yet to find a cartridge that could approach, even remotely, the listening quality of my AUDAX CHROMATIC. I was beginning to feel a bit jittery about when to replace the diamond, and your STYLUS-DISK came as a great relief. I want to thank you for making this ingenious stylus testing device available..." (From a letter)

It is the number one MUST. Without it everything else becomes meaningless. The AUDAX CHROMATIC has that quality to a degree not equalled by any other pickup"...so says violinist David Sarser, of MUSICIAN's amplifier fame (Toscanini's NBC Symphony).

Be it diamond or sapphire, every stylus has a limited life-span: the diamond lasts the longer. Obviously, then, replaceability of the stylus—at home—is of the greatest importance.

But . . . only YOU can decide what sounds best to you. Therefore, See and Hear the Audax CHROMATIC and—You be the judge . . . yet Audax costs no more than ordinary magnetic pickups.

ONLY AUDAX PROVIDES HOME RE-PLACEABILITY OF EITHER STYLUS, INDEPENDENTLY OF THE OTHER



Ask for 1953 ELECTRONIC PHONO FACTS from your dealer

A microscope will show a tiny flat on any diamond after 40 or so hours of play—yet, the jewel is in good playing condition. Hence, in diagnosing wear, it is not the flat but detection of actual cutting edges that is of vital importance. This makes a microscope—(\$15.00 to over \$100.00)—almost useless to an untrained observer. He can see, but he can't judge. The Audak Company has developed the STYLUS-DISK which makes home-testing of any jewel point very simple. If worn or defective the stylus will scrape the delicate surface of the STYLUS-DISK, leaving a visible indication. With proper care, this new STYLUS-DISK should have a life-span of at least 20 styli. Yet it costs only \$6.50 list, \$3.90 net.

If your favorite store hasn't yet received a shipment of STYLUS-DISKS, write to us.

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Creators of Fine Audio-Electronic Apparatus for over 25 years

"The Standard by Which Others Are Judged and Valued"

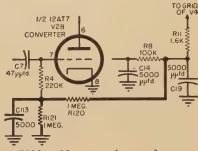
SERVICE HINTS ON G-E TV SETS

810, 811, & 814

Buzz in audio.

This may occur in strong signal areas because the peaks of the signal, which are the vertical pulses, cause the converter grid (V_{2B} , ½ 12AT7) to draw grid current which, in turn, frequency modulates the oscillator voltage at vertical pulse rate of 60 cps.

To remedy this, add bias to the converter grid (pin 7) by the addition of R_{120} and R_{121} , 1-megohm, $\frac{1}{2}$ -watt resistors, and C_{118} , a



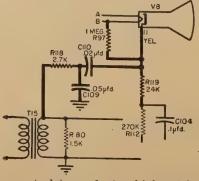
5000- $\mu\mu$ fd. ceramic condenser, as shown in the accompanying diagram.

Proceed as follows:

- 1. Add a terminal board to the underside of the main chassis near the r.f. unit. This board should be mounted so that short leads can be used.
- 2. Remove R_4 from ground under the oscillator trimmer, C_{80} , and connect it to the junction of R_{120} and R_{121} on the new terminal board.
- 3. Connect C_{113} from the junction of R_{120} and R_{121} to the ground point on the r.f. chassis under the oscillator trimmer, C_{80} .
- 4. Dress C_{118} as far away as possible from the oscillator trimmer, C_{80} .

Vertical retrace lines visible.

If vertical retrace lines appear when the contrast control is used on a low setting, or the brightness



control is used at a high setting, do the following:

1. Add a 24,000-ohm resistor, R_{119} ,

between the junction of R_{in} and pin 11 of the CRT. accompanying diagram.)

2. Add resistor R_{118} , and core sers C_{100} and C_{110} , as show the diagram, between pin 1 the CRT and vertical stoutput transformer second

811, 814, 820, 830, & 835

Click in speaker as tuning control justed.

This is an indication of a regeneration, and can be enated by connecting a 500-0 ceramic condenser across that dio i.f. "B+" lead. This contion is made on the term board located between the blimiter tube socket, V₁₈, and discriminator transformer, The condenser is connected tween the "B+" and ground

minals at this terminal boars

Wiggle at top left of picture. To remove this effect, add as ohm, $\frac{1}{2}$ -watt resistor in pawith C_{ss} , the .5- μ fd. paper conser from horizontal size coto horizontal deflection coils:

Flutter on strong TV signals.

This appears as intermittent ter of the picture brilliance of few cycles duration, similal airplane flutter, at very stagnal strength which requirements of contrasts trol.

To correct this conductange C_{255} in the grid circuiti 1) of the 6AU6 first i.f. tube, a .05- μ fd. to a .5- μ fd., 2000 paper condenser.

Also change R_{280} in the circuit (pin 1) of the 12AU7 video amplifier tube from a 000-ohm resistor to an 18,000- $\frac{1}{2}$ -watt unit.

17T10, 17T11, & 17T12

Picture height varies with change in hands ness control setting.

To eliminate this condition move R_{259} , the 150,000-ohm tor from the cathode (pin 1) the CRT to the brightness trol. Replace it with a 220 ohm unit.

Compression on top of picture.

To eliminate this, remove 82,000-ohm resistor, R_{330} , in s with C_{318} , .002- μ fd. condeacross the vertical output to former, and replace it with a 000-ohm unit.

Horizontal instability.

To improve the horizontal syl

 ϕ se receivers, remove R_{279} , the 0,000-ohm feedback resistor, inected from the grid (pin 4) V_{13B} , the 6SN7GT horizontal fillator tube, to the plate (pin of V_{12} , the 6AL5 discriminator. place it with a 330,000-ohm

7T11, 17T12, & 21T2 or vertical linearity.

improve the vertical linearity. ange the vertical output tube f_{10}) from a 25L6GT to a W6GT. These tubes are interangeable, and no wiring change : necessary.

OC105, 20C106, & 21C200

ight picture with black lines.

his may occur when C_{275} , the .1d. condenser in the grid circuit pin 2) of the picture tube is lorted. If this is the case, the cture control, R_{284} , will not ork. Replace this condenser if efective.

m picture, insufficient width and height. heck C_{377} , the .5- μ fd., 200-volt aper condenser, between the brizontal deflection coils and erminal 6 of T_{352} , the horizontal utput transformer. Replace this ondenser if defective.

& 24C101

cess contrast in picture.
This is indicative of circuit overbad, and is primarily due to a oss of a.g.c. control by the 6AU6 eyer tube.

To improve the a.g.c., increase he screen voltage on the 6AU6 eyer tube by replacing the U4GT's. The latter may be givng low emission, resulting in dereased screen voltage to the ever.

TRATOPOWER "E" & "EE" CHASSIS

leak or critical audio tuning.

This may be caused by poor rounding of the shield on the CB6 audio i.f. tube (2nd tube rom the back in the center strip n the chassis).

road black vertical bar on left half of

raster. This may be due to an open tap

n the high-voltage horizontal utput transformer (tap 8 on "E" hassis transformer only).

This may also occur when the oupling condenser from the width control to pin 7 of V_{116B} , the 2AX7 horizontal blanking tube, s open. This condenser is C_{381} on the "E" chassis, and C_{388} on the EE" chassis.

ntermittent operation.

ntermittent operation may be lue to pin 1, of the 6AK5 second .f. tube, shorting to the shield lirectly below the socket. Rockng the 6AK5 will reveal whether his is the cause of the intermit-

ent condition.

To cure this condition, clip bout 1/16" off pin 1 on the 6AK5 ube, and re-insert it in its socket.



70% to 90% off list! OP TUBE BUYS

All Tubes Individually Boxed! Same Day Service! Check this list for Fully 1-Year Guaranteed Tubes.

Туре	Price	Туре	Price	Туре	Price	Туре	Price	Туре	Price
1A5GT	.30	6AF4	.90	6H6GT	.41	12A8	.61	25B06GT	.62
1A7GT	.47	6AG5	.43	6J5GT	.37	12AL5	.37	25LGGT	.39
1B3	.65	6AJ5	90	6J6	.52	12AT6	.37	26	.45
1B7GT	.30	6AK5	.75	6J7G	.43	12AT7	.56	27	.39
1C5GT	.43	6AL5	.38	6K5	.47	12AU6	.38	32L7	.89
1E7	.29	6AQ5	.39	6K6GT	.37	12AU7	.43	35	.58
1G4GT	.24	6AQ6	.37	6K7	.44	12AV6	.39	35B5	.40
1G6	.30	6AR5	.37	6L6	,64	12AV7	.59	35C5	,39
1H4G	.30	6ASS	.50	607	.45	12AX4	.48	35L6GT	.41
1H5GT	.40	6AT6	.37	654	.38	12AX7	.48	35W4	.37
1J6	.24	6AU4	.68	658	.53	12BA6	.38	35Z4	.39
1L4	.46	6AU6	.38	6SA7GT	.43	12BA7	.60	35Z5GT	.37
1N5	.46	6AV5	.83	6SD7GT	.41	12BD6	.45	36	.60
1P5	.57	6AV6	.37	6SF5GT	.46	12BE6	.39	41	.42
105	.58	6AX4	.53	6SG7GT	.41	12BF6	.39	42	.42
1R5	.45	6AX6G	.24	6SH7	.73	12BH7	.63	43	.55
155	.39	6B4G	.64	6SJ7GT	,41	12BY7	.65	45	,55
1T4	.45	6BA6	.39	6SK7GT	.41	12BZ7	.65	45Z3	.44
1 T 5	.53	6BA7	.57	6SL7GT	.48	12C8	.34	45Z5	.49
104	.45	6BC5	.44	6SN7GT	.52	12J5GT	.42	50B5	.39
105	.39	6BD5GT	.59	6SQ7GT	.37	12J7GT	.34	50C5	.39
1 V	.60	6BD6	.45	6SR7GT	.45	1258	.70	50L6G1	.41
1X2A	.63	6BE6	.39	6557	.42	12SA7GT	.44	50Y7	.50
2A3	.70	6BF5	.41	6T8	.56	12SF5	.50	53	.24
2A4G	.24	6BF6	.37	6U4	.60	12SG7GT	.52	56	.24
2W3	.38	6BG6G	1.25	6U5	.44	12SK7GT	.48	57	.58
2 X 2	1.50	6BH6	.46	6U6	.63	12SL7GT	.47	58	.60
3A4	.45	6BJ6	.39	6U8	.61	12SN7GT	,52	70L7GT	1.09
3E5	.46	6BQ6GT	.59	6V6GT	.39	125Q7	.44	71A	.60
3Q4	.48	6BQ7	.95	6W4GT	.44	125R7	,49	76	.44
3Q5GT	.49	6BZ7	.95	6W6GT	.44	12V6GT	.46	77	.57
354 3V4	.46	6C4	.37	6X4	.37	14J7	.30	78	.47
5U4G	.47	6C5GT	.39	6X5GT	.37	14A7	.44	80	.35
5W4	.45	606	.58	6X8	.61	14W7	.30	83V	.68
5 W 4	.50	6CB6	.44	6Y6G	.48	14H7	.44	85	.59
5Y3GT	.32	6CD6G	1.11	7A4	.47	198G6G	.95	117L7	.99
5 Y 4 G	.32	6D6	.45	7AF7 7B4	.53	1908	.70	117Z3	.37
5Z3	.46	6E5	48	7B4 7C6	.44	19T8	.79	807	1.19
6A7	.59	6F5GT	.39	7E6	.40	19V8	.89	1274	.99
6A8	.62	6F6	.37	7E6 7N7	,30	24A	.63	2050	1.85
6AB4	.44	6G6G	.52	7X7	.46				
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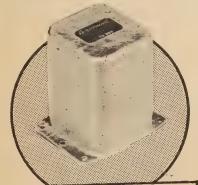
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Modernizing TV Sets

(Continued from page 79)

your set, particularly the noise which is generated in the first few stages. By adding a booster to a television receiver, we essentially cause the noise figure of the booster to become the representative noise figure of the combined booster and receiver.

Why? Because, the noise generated in the receiving system is important only when it is on a par with the incoming signal. This is true only in the first stage or two. If you add a booster to your set, then it is the booster that receives the signal first and so it is the booster noise that is important. At the output of the booster the signal has already been amplified 4 or 5 times and now it is strong enough so that the receiver noise (in its r.f. amplifier stage) is dwarfed by the strengthened signal and can be more or less disregarded.

To show what a good boostere do, examine the figures giver Table 2. Here are shown the figures of the average 1950, 1951, 1952 television receivers for t low- and three high-band v.h.f. c nels. Note again the improver through the years, moving down 11.5 db on Channel 2 in 1950 to db on Channel 2 in 1952.

Now look at the noise figures w these same average receivers are in combination with a booster w itself has a low noise figure. The sults on all three sets, on all change is better than the noise figure f 1952 set by itself. Here is a demon tion of how much the performance every television receiver can be proved by adding a good boosters if you have a set whose perform can be improved, try a booster. 1 a well-designed and well-constru unit you, too, may be able to go the picture shown in Fig. 2 to the shown in Fig. 3.

-30-

RARE TV TROUBLE

By RICHARD BLITZER Tele-Video Associates

EVERY now and then a fault occurs in a television receiver that seems, at first, to have no relation to the symptom. For example what would you think of a split-sound receiver where an inoperative video amplifier, not an i.f. stage, produced no sound as well as, of course, no picture. This fault occurs in RCA receivers using directly-coupled video amplifiers and directly coupled a.g.c. tubes.

By referring to Fig. I we can explain this strange occurrence as follows: First let us see how the circuit operates normally. The detected video signal is applied to the grid of V1, the 1st video amplifier. The amplified signal is taken from the plate and fed to the 2nd video amplifier (not shown). This same signal is also applied to the grid of V2, the a.g.c. rectifier. The amplitude of the signal determines the tube's conductivity. The output of V₂, taken off the cathode, is a filtered d.c. voltage, due to C1, and contains no traces of video signal. Plate current of V₂ determines the d.c. voltage at the cathode. This negative d.c. voltage is applied directly to the grid of V_3 , the a.g.c. amplifier. Plate current of V_3 produces a negative voltage, the a.g.c. voltage at the junction of R_1 and R_2 , which is used as bias for the r.f. amplifier and 1st video i.f. am-

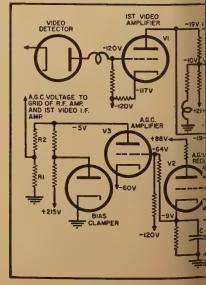
Stronger stations result in larger video signals fed into V₂, the a.g.c. rectifier. Heavier conduction of V₂ makes its cathode output voltage, and the grid of V_3 , less negative (or positive-going). V_3 , the a.g.c. amplifier, conducts more heavily, driving its plate voltage, and the a.g.c. voltage, more negative. The gain of the a.g.c. biased r.f. and i.f. amplifiers are thus decreased, preventing overloading and distortion on the stronger stations.

If V₁, the 1st video amplifier, to get back to our original trouble, becomes inoperative, its plate voltage would go positive from its normal value of about -19 volts. This would cause V₂, the a.g.c. rectifier, to increase conduction. Its cathode would likewise go positive, or less negative, than its normal value of -9 volts. V₃, the a.g.c. amplifier, would

now have its grid going less nege than its normal value of -64 volts, resultant increase of plate current. plate voltage of V₃, and the a.g.c. age, would now be driven so neg that both the r.f. and video i.f. are fiers would be cut off. Picture sound both disappear in the receiver

Usually, when the technician sees a symptom, he suspects those si' which handle both picture and sound the split-sound receiver these, of coare the "front end" stages and any v i.f. amplifiers which also pass sound most do, then these stages should come under suspicion. Measuring a.g.c. stage voltages would, in this ticular trouble, show them up as ab mal. Only when these voltage mean ments were followed back to the video amplifier plate would the ten cian begin to suspect this stage as h the cause of lack of sound.

Simplified, partial schema of an RCA receiver using directly-copled video amplifiers and a.g.c. stags



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Within the Industry

(Continued from page 30)

and engineering activities . . . Sylvania Electric Products Inc. has named EDWARD P. ATCHERLY to the post of merchandising manager of renewal tube sales. He will headquarter in the New York office . . . HARRY GOOD-STEIN has been appointed manager of the precision control division of Clarostat Mfg. Co., Inc. He has been with the firm since 1944 . . . CBS-Columbia has named BERNARD M. DOVER to the post of project engineer. He joins the firm from Emerson Radio & Phonograph Corp. where he headed the tuner engineering department . . . REAR AD-MIRAL THOMAS F. HALLORAN, USN (ret) has been named general manager of the Blair Associates Transistor Development Laboratory in Cambridge, Mass. . . . JEROME J. KAHN, founder and president of Standard Transformer Corporation from 1930 until its recent merger with Chicago Transformer Corp., has announced his withdrawal from active management in the newlyformed Chicago Standard Transformer Corporation . . . The Andrew Corporation has appointed ROBERT P. LA-MONS to the post of sales manager with headquarters in Chicago. He joined the company in 1945 . . . HUGH J. DALY has returned to Eicor, Inc. as sales manager of the tape recorder division. He was with the firm 1946-1948 . . . DeJur-Amsco Corporation has appointed GEORGE WEINMAN to the post of director of industrial and government sales. He will handle the company's line of potentiometers, panel instruments, and electrical connectors . . . THOMAS W. MASSOTH has been named to the newly-created post of operations control manager of the Engineering Products Department of the RCA Victor Division. He has been with the firm since 1930 . . . DOUG-LAS CARPENTER has been named chief antenna development engineer of the JFD Manufacturing Company Inc. of Brooklyn. He was formerly chief engineer for the "Vee-D-X" division of LaPointe Electronics, the Summit Engineering Company, and McMurdo Silver Company, all of the Hartford, Conn. area . . . JOHN W. HINES has been named director of sales of Magnecord Inc., Chicago manufacturer of professional magnetic tape recording equipment. He succeeds C. G. BARKER who resigned . . . RICHARD H. DORF, audio consultant, has been named editorial director of Electronic Handbook Company of 255 W. 84th St., New York City.

NATA of Seattle, Washington, is holding its first annual "Profit Clinic" at the Norseland in Seattle September 27th and 28th.

The Northwest Appliance & Television Association has obtained the services of several well-known speakers who will address the meet. Included



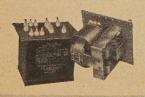


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9356 Santa Monica Blvd., Beverly Hills, Calif. 161 Sixth Avenue, New York 13, New York are Kip Anger, national promotion manager of *Motorola*, *Inc.*; Mort Farr, past-president of NARDA; A. W. Bernsohn, managing director of NARDA; and Wallace Johnson, president of NARDA.

Those wishing additional information about the "Clinic" are invited to write Ed Smith, executive secretary of NATA, 714 American Bldg., Seattle 4, Wash.

GEORGE B. FRASER has been elected president of The Astatic Corporation,

Conneaut, Ohio. He was formerly vice-president and general manager of the firm. He has served as treasurer since he joined the company in 1936 and retains this title along with the top post.



Mr. Fraser was made assistant general manager in 1944 and vice-president and general manager in 1950.

He is the third *Astatic* president since the company was established in the early thirties. Floyd W. Woodworth, one of the founders, was president until his retirement in 1950.

RUFUS P. TURNER, a regular contributor to Radio & Television News, has been awarded the honorary degree of Doctor of Science by Golden State University in Hollywood in recognition of his contributions to radio literature and his simplification of electronic test instruments.

Mr. Turner will serve as a visiting lecturer at the college during the current school year.

JOHN T. CAVIEZEL has been appointed manager of the television sales sec-

tion of the Crosley Division of Avco Manufacturing Corporation.

He joined the company in 1951 as sales promotion manager in the Kansas City zone. He later was made



zone manager of electronics in Kansas City and for the past year has been manager of new market development for television, working out of the central office of *Crosley* in Cincinnati. He will be succeeded by DeWitt Suplee, who has been in charge of the new market development program in the Eastern division.

INTERNATIONAL RESISTANCE COMPANY of Philadelphia has started construction of a plant located in Boone, Watauga County, North Carolina. The plant, to be situated on a 20 acre tract will provide 40,000 square feet of work space. The plant is the company's second to be located in North Carolina . . . GATES RADIO COMPANY has opened a new office and stock distributing warehouse at 7501 Sunset Boule-

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is in charge of the new opera-. . HUDSON RADIO & TELEVISION with headquarters at 48 West street, New York City, has opened salesroom in Newark, New Jerit 35 William Street. The new com will feature a complete of radio and electronic compoand sound equipment.

Los Angeles, California. Robert

N K. ULRICH has joined the Dalogen Company as general sales

* * *

ger, replacing Valter Jablon has resigned he company's president in ge of sales.

Ulrich, for-

renewal sales ger of the Na-1 Union Radio

oration, brings to his new posian unusual combination of sales engineering experience. He is a uate of MIT and served as commercial engineer for CBSon. He is a director of the Radio s Show, a senior member of the a member of the AIEE, and a ber of the Radio Club of America.

IP S. RAND, a project engineer at Remington-Rand Laboratory of inced Research in South Norwalk, n, has been awarded the ARRL's rit Award" in recognition of his ancement of the welfare of amaradio through outstanding leadip and technical accomplishment duction of TV interference."

r. Rand has done extensive re-ch in the field of TVI elimination several years from his home in ling Ridge, Conn. His call is

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ERRATA

the parts list accompanying Fig. 2, page of the July issue ("125-Watt Audio System a Clipping") the value of T₄, the modulate transformer, was omitted. Any plate stormer delivering 1000 volts d.c. at 250 mark be used. may be used.

the third column of the article appearing page 49 of the August issue ("Trouble-bing TV High-Voltage Supplies") the fol-ing sentence appears: "If an arc is ob-ed, touch the screwdriver to the plate of the horizontal output tube." This ald read "If an arc is NOT obtained . . ."

wo of the dimensions given in the side of the Electro-Voice "Regency" (page 51 as August issue) are incorrect. The 534'' ension shown in the lower right-hand corof the diagram should be $83'_{15}''$ while the dimension at the lower left should be . These dimensions are not critical and be varied \pm 10% without affecting perance.

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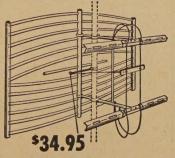
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Audel, Publishers	214	Newark Surplus Material Co
Barry Electronics Corp	216	Nichols Wire & Aluminum Co
Bell Telephone Labs., Inc40,	200	Ohmite Mfg. Company
Boulevard Electronics, Inc	116	Peak Electronics Co
Brook Electronics, Inc.	158	Perma Power
Brooks Radio & Television Corp	154	Phileo Corporation
Buchan Company, R. J.	186	Phillips Tube Company, Incorporated Photocon Sales
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Candler System	214	Platt Flectronics Corn.
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Capitol Radio Engineering Institute	. 125	Punim Surplus
Centralab	217	RCA Audio Equipment
19, 28, 148, 164, 174, 182, 186, 213, Century Electronics Co	206	RCA Institute, Inc
Channel Master Corporation36	, 37	R W Electronics
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DeCray & Assoc., Frank W	190	Rad-Tel Tube Co
Delco Radio Corporation3rd C	over	Raytheon Mfg Company
		Reeves Soundcraft Corp
Eastern Telephone Co	116	Rinehart Books, Inc
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Electronic Expediters, Inc. Electronic Instrument Co., Inc	.213	Sams & Co., Inc., Howard W
134 146 150	191	Schott Company, Walter L
Electronic Specialty Supply Co88,	203	Scott, H. H
Electro Voice	. 8	Shields Labs., Inc.
Espey Manufacturing Co., Inc.		Simpson Electric Co
Fair Radio Sales	200	South River Metal Products Co., Inc
Falcon Electronics Co	. 33	Sprague Products Company16,6
Federal Telephone & Radio Corporation	87	Sprayberry Academy of Radio Stan Burn Radio & Electronics Co
Fisher Radio	153	Standard Surplus
		Standard Transformer Corp
G & G Radio Supply Company	181	Stephan Sales Corp
G. L. Electronics	.136	
General Cement Manufacturing	. 14	Stevens Walden, Inc. Sun Parts Distributors, Ltd.
General Electric41,	123	Supreme Publications
Good, Inc., Don	189	Superex Electronics
Greenlee Tool Co	161	TAB
Hallicrafters	7	Technical Appliance Corp.
Harrison Radio	150	Tech-Master Products Co
Harrison Radio	172	Tee-Vee Supply Co
Hawkins Name Plate Company	. 189	Television Communication Institute Television Materials Corporation150,
Heath Company94	105	Terado Company
Henry Radio Stores	.128	Terminal Radio
Henshaw Radio Supply. Hi-Lite Electronic Sales Co.	184	Transvision, Inc.
nonywood rechnical institute	114	Triad Transformer Mfg. Co
Hudson Radio & TV Corp. Hughes Research & Development	. 187	Triplett Electrical Instrument Co
Laboratories92,	110	Tri-State College
I. E. Manufacturing Co	171	Tung-Sol Electric IncTurner Company, The
Indiana Technical College	195	United Technical Laboratories142,
Instructograph Company	.192	Utah Radio Products Co
International Correspondence Schools International Resistance Co.	. 13	
	117	V-M Corp
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Kay-Townes Antenna Company140,	141	Westinghouse Electric
Rester Solder Company	124	Windsor Electronics Tube Co
Kirk, Jim	.186	World Radio Laboratories, Inc.